
Liber hic cui titulus,
The ANATOMY of Humane
Bodies Epitomized,
IMPRIMATUR.

John Micklethwait, President.

Daniel Whistler Elector and Cenfor.

<i>Samuel Collins,</i>	}	Censors.
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THE
ANATOMY

Of Humane Bodies

EPITOMIZED.

WHEREIN

All the Parts of Man's Body,

WITH

Their ACTIONS and USES,

ARE

Succinctly described, according to the newest doctrine of the most accurate and learned Modern Anatomists.

By a Fellow of the College of Physicians, London.
Thomas Gibson.

L O N D O N,

Printed by *M. Fleisher* for *T. Fleisher*, at the
Angel and Crown in *St. Paul's Church-*
Yard. MDCLXXXII.





Jacobus Burroughs Miles.

22...734

TO THE
READER.

IN relation to this Treatise I think my self obliged to account for two things; First, why I publish any thing of this nature; secondly, why in English.

As to the first; I must confess it was not any Ambition to become an Author that put me upon it; but another occasion. The Bookseller for whom this is printed, (my particular Friend) thinking to make a new Impression of a Book intituled The Manual of the Anatomy or Dissection of the Body of Man, written by Dr. Alexander Read, a Fellow of the College of Physicians, London, desired me to peruse it, and if in any place I observed it erroneous, to alter it. Understanding that the Book had been writ many years agoe, (that which was brought to me being the fifth Impression, and that printed in 55.) I was unwilling to meddle with it, suspecting that

To the Reader.

there must needs be very considerable Errors in it, so many new things in Anatomy having been discovered since that time. However at his importunity I undertook it: and before I had lookt over a Sheet, I saw I was not deceived. For though I had resolved to give my self no further trouble than was necessary, yet I found that if I would mend all that was amiss, I must in effect write a new Book. Which I have really done, as any one will find that will take the pains to compare this with that writ by Dr. Read, for he will see very little of that retained except the method, which indeed is but little alter'd; for though it differ pretty much from the modern, yet I think 'tis every whit as convenient.

As to the second, Why I should write it in English; I have two things to alledge: First, The example of him that has gone before me, who was a person (as I am informed) eminent in his time. Secondly, to avoid the injury of a paltry Translator, if it should be well accepted. For we see there is no Man that publishes any thing in the Latin tongue, that is received with any applause, but presently some proggings Book-seller or other finds out an indigent Hackney scribler to render it into English. But with what dis-reputation and abuse to the worthy Authors, every learned person cannot but observe. So that he that shall think to redeem the noble
faculty

To the Reader.

faculty and art of Physick out of the hands of the Mechanical Quacking Tribe by publishing every thing in a language above their understanding, will not only fail of his end, but find himself abused and disgraced into the bargain.

And now as to the Work it self, the main design of it is to pleasure those that are entring upon the study of Physick; for herein they may see in short, what afterwards they shall find more largely treated of in other Authors. And perhaps it may not be altogether unusefull even for such as have made some proficiency in that study; for it will serve at least as an Index to bring to their remembrance what they have read more fully elsewhere; and will save them the labour to make such a Compendium for their own use. There is little that is new in Anatomy, but the Reader will find a taste of it here. Which he will be rather expect to meet with, when he understands that most of these following learned Anatomists are in some measure Epitomiz'd in it.

Authors made use of in this Treatise.

Adrian. Spigel. de humani Corporis fabrica.
Isbrandi de Diemberbroeck Anatome Corporis humani.

Thomæ Bartholini Anatome.

Dr. Willis de Cerebro.

— *de primis viis, and de respirationis organis, in the first and second part of his Pharmaceutice Rationalis.*

Dr.

To the Reader.

Dr. *Lower's* Tractatus de Corde.

Dr. *Glisson's* Tractatus de Ventriculo & Intestinis.

——— Anatomia Hepatis.

Dr. *Charlton's Enquiries into Humane Nature in IV. Anatomick Prelections in the New Theatre of the Royal College of Physicians in London.*

Dr. *Harvey's Exercitationes Anatomicae de Cordis motu & circulatione Sanguinis.*

——— Exercitationes de Generatione Animalium.

Malpighius de Viscerum structura.

——— Exercitationes Epistolicae de Cerebro, Lingua, &c.

Dr. *Grew's Comparative Anatomy of Stomachs and Guts, subjoined to his Museum Regalis Societatis.*

Dr. *Brigg's Ophthalmo-graphia, sive Oculi ejusque partium descriptio Anatomica.*

Regneri de Graef Opera omnia.

Johannis Swammerdami Miraculum Naturæ, sive Uteri Muliebris fabrica.

Dr. *Walter Needham's disquisitio Anatomica de Formato Fœtu.*

Dr. *Crone de ratione Motûs Musculorum.*

Dr. *Wharton's Adenographia, sive Glandularum totius Corporis descriptio.*

With several others.

The

The First Book.

OF THE
LOWEST CAVITY,
CALLED
ABDOMEN.

CHAP. I.

*Of the division of the parts of the Body of
Man in general.*

ANATOMY is an artificial separation of the parts of the Body by section, practised to attain to the knowledge of the frame of it, and the use of each part.

In Anatomical exercises, first the whole Carcase doth offer it self, then the parts.

The whole hath four Regions, to wit, the fore and back parts, and the lateral, which are the right and left.

B

I call

What the
whole and
a part
signifie.

I call the *whole* that which containeth the parts, and a *part* that which is contained in the whole, according to the most ample acception of the term *part*; for in a more strict acception that is called a *part*, which partakes of the *form* and *life* of the whole; and is defined to be a *body solid* cohering with the whole, endued with *life*, and framed to perform some function.

Things re-
quired in a
part being
strictly ta-
ken.

A *part* then must be first *solid*: humours then cannot be numbred amongst the parts, because they are fluid.

Secondly, it must have *life*: and so the excrements of hairs and nails are not to be accounted parts.

Thirdly, one part must not nourish another: and so the blood, fat, and spirits are not parts.

Fourthly, it must have a *circumscription*.

Fifthly, it must be united with the whole, both in respect of matter and form.

Sixthly, it must have some *function*, or *use*.

The diffe-
rences of
the parts.

The principal differences of parts are taken either from their *matter*, or *end*. From their *matter*, parts are said to be either *similar*, or *dissimilar*.

What a si-
milar part
is.

A *similar* part is that whose particles are of the same substance and denomination with the whole: as every portion of a bone is bone. It is otherwise called a *simple* part.

The num-
ber of sim-
ple parts.

Of *simple* parts there are ten in number, to wit, The *skin*, a *membrane*, the *flesh*, a *fibre*, a *vein*, an *artery*, a *nerve*, a *ligament*, a *cartilage*, a *bone*: they are comprehended in these two verses.

*Cartilago, caro, membrana, arteria, nervus,
Vena, ligamentum, cutis, os, lenissima fibra.*

of the Body of Man.

3

To these a *tendon*, which is the principal part of a *tendon* of the muscle, may be added; for the substance of it is simple, without any composition.

Of the former simple parts, some are *simple in- The differences of simple parts.* deed, and these are in number seven; the *skin*, a *membrane*, the *flesh*, a *fibre*, a *ligament*, a *cartilage*, a *bone*. The rest are onely *simple to the eye or sense*, and not to reason; for a nerve (for example) is composed of many filaments, covered with a double membrane, made of the *dura*, and *pia mater*.

Of the *simple parts* some are called *spermatical*, as a bone, a cartilage, a ligament, a membrane, a fibre, a nerve, an artery, a vein; these being made of the seed, if they be cut in two, or broke, are not regenerated, nor can truly be again united; but are onely joyn'd by a *callus*. Others are *sanguineous*, being suppos'd to be made of blood, and these are regenerated, such is all the muscular flesh. As for the skin, it seems to be partly spermatical and partly sanguineous; for though in grown men a wound in it is healed onely with a *cicatrix*, yet in boys it has been observed to be closed with a true and proper skin. But of its nature see more in the next chapter.

A *dissimilar part* is that whose portions are neither of the same substance, nor the same denomination; as a *muscle*, in the which are flesh, nervous fibres, and a tendon. It is otherwise called a *compound part*, and an *organical part*. What a dissimilar part is.

In an *organical part* four particles are commonly found; as in the Eye, there is first, the chief particle, by which the action, namely vision, is performed, which is the crystallin humour. Things to be observed in an organical parts
1.

2. Secondly, that particle, *without which* the action cannot be performed, as the optick nerve.
3. Thirdly, that which *furthereth* the action, as the membranes and muscles.
4. Fourthly, that by which the action is *preserved*, as the eye-lids.

The degrees
of an orga-
nical part.

Of *organical* parts there are *four degrees*.

The *first* is made onely of the similars, as a muscle.

1. The *second* receiveth the first kind of organical parts, and other similars, as a finger.
2. The *third* admitteth those of the second degree, as the hand.
3. The *fourth* is made of the third and other parts, as the arm.

The differ-
ences of
parts ta-
ken from
their end.

Parts from their end are distinguished into *principal*, and *less principal* or *ministring*.

The *principal* are the Liver, Stomach, Heart, Brain.

The *ministring* are either *necessary*, or *not*.

The *necessary* are those without which the Animal cannot live. So the Lungs minister to the Heart, the Guts to the Stomach.

The *not necessary* are simple flesh, &c. in respect of other parts: for in consumptive persons 'tis almost wholly spent; and Insects, according to Aristotle, have none.

There are also other divisions of the parts of the Body, as into parts *containing*, parts *contained*, and the *spirits*, express'd by *σπύρματα*, or *impetum facientes*, by Hippocrates.

Fernelius divides the Body also into *publick* and *private Regions*. The *private* are such as the brain, reins, womb, &c. The *publick* are three. The first hath the *Vena porta*, and all the parts whither its

its branches reach. The second begins at the roots of the *Cava*, and ends in the small veins before they become capillary. The third hath the muscles, bones, and the bulk of the Body, terminating with the skin. But this division is only of use in Physick.

CHAP. II.

Of the circumscription, regions, and parts of the Abdomen.

OF all the parts of the Body we are to begin Dissection with the Cavities: First, because they offer themselves to the view in the fore region of the Body. Secondly, because they being moist, and apt to receive the impressiion of the external heat, soonest putrefie and send out noisom smells.

The Cavities are appointed to receive the principal parts, and those which minister unto them. Wherefore there are three Cavities, according to the number of the principal parts. The Head is for the Brain, the Breast is for the Heart, and the Belly for the Liver. And because this last Cavity is most subject to putrefaction, you are to begin at it.

Now three things concerning it offer themselves. First the circumscription or bounds of it. Secondly, the regions of it. Thirdly, the special parts of it.

The circumscription of the Abdomen.

The regions of it.

As concerning the *circumscription* of it, it is severed within from the Breast by the Midriff. It is bounded above by the *cartilago ensiformis*, or the Heart-pit, and beneath by the Share-bones.

The *regions* of it are three, the uppermost, middlemost, and lowermost.

The *uppermost*, which is bounded between the *mucronata cartilago*, and three inches above the Navel, about the ending of the short Ribs, hath three parts: The two lateral, which are called *hypochondria*, or *subcartilaginea*, because they lie under the cartilages of the short Ribs. In the right *hypochondrium* lieth the greatest part of the Liver, and part of the Stomach, but in the left the Spleen, and a greater part of the Stomach. The third part is that which before lieth between the two lateral parts, and is properly called *epigastrium*, because the Stomach lieth under it. In this part remarkable is the Pit of the Breast, which is called *cardia*, or *scrobiculus cordis*, by the modern Writers.

The *middlemost* region extendeth it self from three inches above the Navel, to three inches under it. The fore part is where the Navel is, from whence it is called *regio umbilicalis*. The two lateral parts are called by *Aristotle* *λαγναι*, either from their laxity, or from *λαγναια*, *salacitas*, because they are the seat of lust; by *Galen* *κατακτα*, because being placed between the hanch-bones and Ribs they are lank and seem to contain nothing. They are called by *Dr. Glisson* *epicolica*, because on each side, this region investeth the lateral parts of the Gut Colon. The hindermost parts parallel to these are called *lumbi*, the Loins, in the right whereof is the right Kidney, and in the left, the left.

The

The lowest region is called *hypogastrium*. This region hath three parts, the two lateral, and the middlemost: The lateral are bounded by the *assa illia*, so-called because a great part of the *Ilium intestinum* lieth under them on each side. Besides this, in the right part are placed the beginning of the *Colon*, and the *cæcum intestinum*, which latter is joyned as an appendage betwixt the *Ilium* and *Colon*. In the left part are contained the ending of the *Colon*, and the *intestinum rectum*.

The fore-part of the *Hypogastrium* by *Aristot. lib. 1. Hist. animal. 3.* is called *aræon*, which *Gaza* calleth *Abdomen* and *Sumen*. Under it lieth the *pubes*, which word signifieth both the hairs, and the place where the hairs grow, which appear to bud in Girls the twelfth year, but in Boys the fourteenth year, when way is made for the monthly courses, and seed begins to be generated. At the sides of the *pubes* appear *Ciccoræ*, or *Inguina*, the Groins. Under this lowest region in its middle are contained the Bladder, and the Matrix in Women.

Behind, it is terminated by the *os sacrum*.

CHAP. III.

Of the common containing parts of the Belly.

TH E common containing parts of the Belly are four, the *scarf-skin*, the *skin*, the *fat*, and the *membrana carnosæ*.

The *skin* in a Man is called *cutis*, but in Beasts *aluta*; in Greek it is called *δέρμα*, and *δέρμα*; either *ἀπὸ τοῦ δέρματος*, because it is easily flea'd off; or from *τέρμα*, seeing it is the end and superficies of the whole Body. Of all the membranes of the Body it is the thickest.

1. Cuticula, or scarf-skin.

It hath a double substance; the one is external, called *ἐκδέρμα*, *ἐκ δὲ τοῦ δέρματος τὸ ἐξώτερον*, because it is placed upon the Skin as a cover. It is termed *cuticula* in Latine, and is as large as the Skin, and more compact; for waterish sharp humours, passing through the Skin, are stayed by the thickness of this, and so pustules are caused. In Man it is as the peeling of an Onion. It is without blood and without feeling.

The material cause of it is a viscous and oleous vapour of the blood, raised by the natural heat of the subjacent parts, and dried and condensed by the external cold, as most Anatomists have taught; but Dr. *Glisson* not improbably thinks it to be a soft, slippery, viscid and transparent juice (like the white of an Egge) issuing out of the capillary extremities of the Nerves which end in the outer superficies of the true Skin, where it is coagulated, and by its viscosity sticketh upon it like glue, so that it can hardly be separated therefrom

from by a knife, but easily in living creatures by a vesicatory, and in dead persons by fire, or scalding hot water. It sometimes also almost wholly peels off in burning fevers, and the small pox; but a new one presently succeeds it.

The use of it is First, to defend the Skin, which *its uses.* is of an exquisite sense, from external immoderate either heat or cold. In cold weather it breaketh the cold, that the perspiration should not be altogether hindred: In hot weather by its compactness it hindreth too great perspiration.

Secondly, to be a middle between the Skin, and the object to be felt; for when it is rubb'd off, the true Skin cannot endure the touch of other Bodies without pain.

Thirdly, to stay the ichorous substance from issuing from the Arteries; for this we see when the *cuticula* is rubbed off by any means.

Fourthly, to make the Body more beautifull; which it does by smoothing the asperities of the true Skin, and inducing a comely colour of white and red. Whiteness is natural to this part, and the redness is owing to the blood that is affus'd to the outward superficies of the true skin; which being seen through the Skarf-skin makes that florid colour.

The *true skin* is six times thicker than the Skarf- *2. The true skin.* skin: in Children, Women, and those which are born in hot Countries, it is thinner; but in Men, and in those who inhabit cold Countries, it is thicker.

It is naturally white, as other membranes; *its colour.* but in living and healthfull persons, and such as live in a temperate or somewhat cold climate, from the afflux of the blood towards it, it is of a reddish

reddish rose colour. But in those that live under the Æquinoctial Line and in excessively hot climates it appears black in the outer superficies, because they having a softer Skin, and large pores and loose, many vapours of the adust humours are raised with the sweat; the grosser substance whereof, (being stop'd by the Scarf-skin, and) by reason of the excessive heat, being dried and burned, causeth that blackness; for their infants are not born black but reddish.

It is made up of nervous fibres very closely interwoven one with another, and of a parenchyma that fills up the interstices and inequalities thereof. That it has such a parenchyma may appear by this, that when a Sheep-skin (for instance) has been some while steeped in water, one may with an ivory knife or the like scrape a great deal of mucous slimy matter off it, whereby it becomes much lighter, thinner and in some measure transparent, as we see in Parchment.

The Skin in the Fore-head and Sides is thin, thinner yet in the palm of the Hand, but thinnest of all in the Lips and Cods. In the Head, Back, and under the Heel it is thickest. Under the Heel the *cuticula* in some will be as thick as a barley corn, and may more truly be called a *callus* than a *cuticula*; and such it is in the palms of the Hands of such as much handle hard things, as Smiths, and the like. It is thinner in Children and in Women than in Men; in those that live in hot Countries, than those that live in cold. And this (as *Spigelius* observes) is the reason why those that are born in cold Countries, when they come under the Æquinoctial Line, are often taken with fevers; because that great heat that is there

there excited in the Body by the outward air, cannot exhale through the too thick Skin, but being retained induces a preternatural heat, and so a fever.

The pores will appear in the Skin in the winter time, it being bared; for where they are, the *cuticula* will appear as a Gooses Skin.

The Skin hath an action, to wit, the sense of *its action*. feeling.

Its use is, first, to cloath the whole Body, and *its uses*. defend it from injuries. Secondly, to be a general vent or emunctory to the Body, by which all its exhalations may fitly transpire. Which whether it be done onely through its pores, as most Anatomists have affirmed; or also through its very substance, as Dr. *Glisson* has of late asserted, is a controversie hardly worth the insisting on.

In the next place appears the *fat*, which is commonly taken to be something distinct from the *membrana carnosæ* that lies under it; but is indeed onely a part of it: for in its outer part it is full of membranous cells, which are fill'd with a yellowish fat. But however having noted this error, we shall speak after the manner of former Anatomists, and consider it as separate, and so define it to be *an oleous humour of the Body elevated by the moderate heat of the parts lying under it, and concreted betwixt the carnosæ membrane and the Skin in membranous cells*. Now though in Men this fat is immediately next to the Skin, yet in Beasts the *membrana carnosæ* comes between, and is indeed musculous, and so close joyned to the Skin that by the help of it they can (many of them) move the Skin so as to shake off flies or any thing that offends them: but it is not so in Men in any place

place save the Fore-head, which therefore they can move in like manner.

This Fat is properly called *pinguedo*, whereas that of the Caul, &c. is called *sebum*, Suet or Tallow. And they differ in this, that *pinguedo* is easily melted, but not so easily congealed; but *sebum* is not easily melted, but is easily congealed. Besides, *pinguedo* is not brittle, but *sebum* is.

Its uses.

The uses of it are these: First, it defendeth the Body from the air; so Apothecaries, when they mean to preserve juices, pour oyl upon them.

Secondly, it preserveth the natural heat.

Thirdly, it furthereth beauty by filling up the wrinkles of the Skin.

Fourthly, in the Muscles it filleth up the empty places, rendreth the motion thereof more glib and easie, (so it do not abound too much) and keepeth all the parts from drinefs, or breaking. Hence it besmeares the extremities of the Cartilages, the joyntings of the greater Bones, and the Vessels that they may pass safely.

Fifthly, in a special manner it helpeth the concoction of the Stomach; whence the Caul being taken out, there follow *flatul* and belchings; and in such case it is necessary to fence the Stomach extraordinarily with outward warmth.

4 Mem-
brana car-
nosa.

Membrana carnosa, or *μλινὴ συγκρίσιμη*, so called in Man; not that it is in him fleshy, (but nervous, and so should rather be called *Nervea*;) but because in Beasts, which the Ancients used most commonly to dissect, it is endued with fleshy Fibres. In the birth it is red, but in those of ripe age white; in the Fore-head and Neck it is more fleshy. Within it is bedewed with a viscous humour, to further the motion of the Muscles by keeping

keeping the superficies of them from desiccation ; which otherwise might fall out by reason of their motion. It is of an exquisite sense, wherefore when it is pricked with sharp humours, it causeth shiverings, such as are felt in the beginning of Ague-fits.

First it preserveth the heat of the internal *its uses.* parts. Secondly, it furthereth the gathering of the fat. Thirdly, it strengtheneth the Vessels which pass between it and the Skin.

In the next place (according to the usual method of Anatomists) we should come to speak of the Muscles of the *Abdomen* with their Membranes, &c. But we have thought it more convenient to treat of the Muscles of the whole Body in a particular Book, and so shall but only name the Muscles of the lower Belly here, as they appear one after another to the dissector. And first there shew themselves the obliquely descending pair; secondly, the obliquely ascending; thirdly, the *Recti*; fourthly, the pyramidal; and lastly, the transverse. All these being removed, there appears the *peritoneum*, of which in the next Chapter.

CHAP. IV.

Of the proper containing parts.

THE proper containing parts are the Muscles of the Belly, and the *Peritoneum*. Of these Muscles we shall speak *Book 5. Chap. 17.*

The

The *Peritonæum* or inmost coat of the Belly (derived ~~from the~~ *περιτοναϊκόν*, from its office of encompassing) is tied above to the Midriff, below to the Share and Flank-bones; in the fore-part firmly to the transverse Muscles, but chiefly to their Tendons about the *Linea alba*; behind to the fleshy heads of these Muscles loosely. The end of this firm connexion is to press equally the Belly, for the expulsion of the Ordure, and for respiration. If this connexion had not been, the *Peritonæum* would have become wrinkled, the Muscles being contracted. If it had not been loose tied to the fleshy parts, the contraction of them in the compression of the Belly had been hindered.

Its figure is oval; its substance is membranous; the inner superficies of it, which respects the Guts, is smooth, equal and slippery, bedewed with a kind of watery humour contained in the *Abdomen*; but the outer superficies, whereby it cleaves to the Muscles of the lower Belly, is rough and unequal.

As for the origine of it, *Fallopini* will have it to proceed from that strong *plexus* of Nerves, from whence the *Mesenterium* is said to have its beginning. Some will have it to proceed from the Ligaments by which the *vertebra* of the Loins and of *Os sacrum* are tied together. *Piccolbomineus* will have it to be framed of those Nerves which spring out of the *spinalis medulla*, about the first and third *Vertebra* of the Loins. But *Fallopini*'s opinion seems the most probable; for there it cannot be separated without tearing, and is very thick.

It is double every where, but appears so to be chiefly

chiefly about the *vertebrae* of the Loins, where between the duplications lie the *Vena cava*, the *Aorta* and the Kidneys. In the *Hypogastrium* two Tunicles are also apparently seen, between which the Bladder and Matrix lie. The umbilical Vessels also are placed in the duplicature of the *Peritoneum*, that they may march the more safely. Above, where it is tied to the Midriff, it has three *foramina* or holes; the first on the right side, whereby the ascending trunk of the *Vena cava* passes; the second on the left side, for the Gullet (with the Nerves inserted into the mouth of the Stomach) to descend by; the third, by which the great Artery or *Aorta*, and the Nerve of the sixth pair may pass. Below, it has passages for the strait Gut, for the neck of the Bladder, and in Women for the neck of the Womb; also for the Veins, Arteries and Nerves that pass down to the Thighs. Before, in the *femur* for the umbilical Vessels and the *Urachus*.

But the most remarkable are its two *processes*, placed before near the *os pubis*, on each side one. They are certain oblong productions of its outer Membrane passing through the holes of the Tendons of the oblique and transverse Muscles, and depending into the Cod, there bestowing one Tunicle on the Stones. There are also two processes in Women, but they reach only to the *inguina* or Groins, and terminate in the upper part of the Privy or the fat of *mons Veneris*. The inner Membrane of the *peritoneum* (in Men) reaches but to the very holes, which it makes very strait; but being either relaxed or broken, the outer gives way, and so there follows a rupture, either the Caul, or the Guts, or both descending thereby. By the holes of the processes there descend

in

in Men the Vessels preparing the seed, and the Muscles called *cremasteres*, and by them ascend the Vessels bringing back the seed. In Women there pass by them the round ligaments of the Womb, which after growing somewhat broadish, are joynted to the *clitoris*, or else terminate in the fat of *Mons Veneris*.

The *peritoneum* is thickest below the Navel, for that when one either sits or stands, his Intestines bear down heavy on that part, so that unless it were there stronger than ordinary, it would be in danger of breaking. In Women with child also, it is very much extended in this region. And thus far of the parts containing.

The Explication of the Figure.

AA The coverings of the Abdomen dissected, and turned back, that the inner parts may come to view.

B The sword-pointed Gristle, or cartilago ensiformis.

CC The gibbous part of the Liver.

DD The Stomach.

EE Part of the Colon placed under the Stomach.

FFFF The upper membrane of the Omentum knit to the bottom of the Stomach.

G The Navel.

HH The umbilical Vein.

II The two umbilical Arteries.

K The Urachus.

L The Bladder.

aaa The gastropiploical Vessels dispersed through the Caul and Stomach.

MM The Intestines.

CHAP.



CHAP. V.

Of the Omentum.

THE parts contained serve either for *nutrition*, or *procreation*. As for the parts serving for *nutrition*, they either serve for *chylification*, or *sanguification*. The principal efficient cause of *chylification*, is the Stomach; but the adjuvants are the Caul, and the *Pancreas*. Of the parts contained in the lower belly.

The principal efficient causes of *sanguification*, have been held to be the Liver and Spleen, and the other parts to be adjuvant causes. But since it has been discover'd that none of the *vena lactea* pass to the Liver, but that the whole chyle is conveyed by the *ductus thoracicus* to the Heart and so into the mass of Blood, they are discharged from the task of *sanguification*; though they do contribute to the refining and perfecting of the Blood already made.

The excrements of the *chylification* are received by the Guts. The excrements of the *sanguification* have been taught to be two, *viz.* choler, and the serous humour. The thin choler is received by the *vesica fellea*; but the thicker by the *meatus cholidochus*. The serous humour is turned to the Kidneys, and from thence to the Bladder by the Ureters.

The parts appointed for *procreation*, are the Genitals, both in Men and Women.

Next then to the *Peritoneum* is the *Omentum*, The caul. or Caul, in Greek it is called *ἐπιπλάου*, *Ἐπὶ τῇ στήθεσσι*, because it seemeth to swim above the upper

Its substance.

Its connection or origine.

upper Guts. The *Arabians* call it *Zirbus*.

It is composed of two Membranes, of Vessels, Glands and Fat.

The uppermost Membrane doth spring from the bottom of the Stomach, and is tied to the hollow part of the Liver and Spleen.

The inner or lowermost doth spring from the *Peritoneum*, immediately under the Midriff towards the Back, and is tied to that part of the Gut *Colon* that passeth under the Stomach lengthways, to the *Pancreas* or Sweetbread, to the Midriff, and to the *Duodenum intestinum*.

Its lower part doth hang loose and reacheth in most below the Navel, but in some that are fat to the very *os pubis*. Its bottom is close and united, so that it is fitly compared to a pouch.

From its double origine there ariseth betwixt its partitions a notable cavity, which some very weakly have destin'd to divers uses; but indeed it results onely accidentally, and was not for its own sake framed by Nature. "For (as Dr. *Glisson* reasoneth) whilst Nature is solicitous about "providing a fit deputy for the Mesentery (and "that membranous) and stuffing it with fat, "through which vessels may be carried to the "Stomach, Liver, Spleen, *Pancreas* and *Colon*, "and whereby she may joyn all those parts after a "due manner; and moreover whilst she takes care "that it hang down loosely, and besmear both "the Stomach and Intestines with its unctuousness; and in the mean while be every where "continuous to it self: I say, whilst she diligently "proposes all these ends, if she will obtain them, "she must needs make the Caul hollow as it is "above described, and its propending part "must

“must needs imitate the bottom of a pouch.
Thus he.

The *Omentum* aboundeth with Vessels of several ^{Its vessels:} sorts; we shall begin with the Arteries, and translate hither the account that the above-named Doctor gives of them, which is very exact. “Its
“Arteries are propagated from the *coeliaca*; or
“rather the inner Leaf (as he calls it) of this
“Membrane, near its origine, receives and up-
“holds this Artery, (as soon as it passes out of
“the *Aorta*) betwixt its Membranes. It is di-
“vided into two branches, the *right* and *left*.
“The *right* being joyned to the *vena porta* in the
“*pancreas*, and fenced with the Membranes of
“the *omentum*, is carried into the *cava* of the Li-
“ver: but it first sends forth these branches; the
“*pyloricus*, to the hinder side of the right orifice
“of the Stomach; the *arteria cystica gemella*, the
“*epiplois dextra*, a portion whereof is dispensed
“to the Gut *colon*; the *intestinalis* carried to the
“*duodenum* and beginning of the *jejunum*; the
“*gastro-epiplois dextra*, which is distributed into
“the right bottom of the Stomach — The *left*
“branch of the *coeliaca*, called *splenicus*, is greater
“than the *right*, and being included within the
“Membranes of the hinder Leaf of the *omentum* is
“carried directly left-ways to the future of the
“Spleen under the bottom of the Stomach. In
“its passage it sends forth many branches: Up-
“wards one notable one called *arteria gastrica*,
“which washeth the bottom and sides of the Sto-
“mach and its upper orifice, and there gets the
“name of *coronaria*; also a *second* called *gastro-*
“*epiplois sinistra*, whereof one portion is disper-
“sed into the bottom of the left part of the Sto-
mach,

mach, and both its fore and hinder parts, and the remainder is spent on the fore Leaf of the *omentum*; it sends forth a third also, that famous branch called *vas breve arteriosum*, which is inserted into the left part of the left orifice of the Stomach. Downwards also it shoots forth some branches, as the *epiploe sinistra*, which being divided into two rivulets waters partly the hinder Leaf of the *omentum*, and partly the *colon* it self; also another little branch, which is wholly spent on the left part of the hinder Leaf of the Caul.

2. Veins.

"The Veins that answer to the said Arteries rise almost all from the splenick branch, the trunk of which Veins after it is joyned with the stem of the splenick Artery, puts forth branches exactly answering and proportioned to those of the said Artery; and all the branches of both Vessels are dispensed to the same respective parts, and are denominated from them, so that 'twould be needless to stay longer on their distribution: only the branch that goes to the right orifice of the Ventricle, called of some *pyloricus*, takes its rise from the trunk of the *porta* before 'tis divided.

3. Nerves.

It has but very small nerves proceeding from a double branch of the sixth pair: and these, as the Veins, accompanying the Arteries, and having the same names, we shall not take the pains to trace.

4. Vasa adiposa.

But besides these Vessels formerly known, there are some that think they have discovered another sort called *adiposa*; amongst whom *Malpighius* is a leading man: whether there be such or no, I leave the curious with their glasses to inquire; for
for

for my own part, I could never discern any such by the naked eye, or such glasses as I have made use of.

Dr. Wharton in his Book *de Glandulis*, cap. 12. ^{s. Vena lactea.} declares, that he has observed some *vena lactea* arising out of the bottom of the Stomach, to be received into the *omentum*, which being inserted into a pretty large gland do from thence spring again, and are carried obliquely downwards, crossing the right extremity of the *pancreas*: one would think, saith he, at the first sight, that they enter'd into the *pancreas*, but they do in truth pass by it, and make towards the common receptacle of the Chyle, into which they unload themselves.

The same learned Physician does in the same place give an account of two Glands that are naturally found in it. One *greater* near its being joyned unto the *pylorus*, and into this it is that the *lactea* are inserted; another somewhat *less* placed towards the Spleen, and this he has observed sometimes double, triple, yea manifold. Preternaturally it has sometimes many more. ^{its glands.}

The fat is about the Veins and Arteries, to ^{its fat.} strengthen them, and to keep them from being compressed by the repletion of the Belly, and other motions. When the Stomach is full, and the Guts empty, the upper Membrane of the Caul is raised, the lower remaining in its own place; but if the Guts be full, and the Stomach empty, then the lower Membrane riseth up, the upper remaining in its own place; for which end its lower end is free and untied, that sometimes the upper, sometimes the lower Membrane might rise up, saith *Spigelius*.

Uses.

The uses of it are these: *First*, it cherisheth the internal heat of the lower part of the Stomach, and of the Intestines.

Secondly, it ministreth nourishment to the parts in the time of famine, *Galen. de us. part. l. 2. c. 11.*

Thirdly, like the Mesentery, it serves to convey safely the Vessels to other parts, as to the Stomach, *Colon, Duodenum, &c.*

Fourthly, it keeps the outer superficies of the Guts moist and glib, that they may the better perform their peristaltick motion.

An observation.

Creatures which have no Caul, help concoction by doubling their hinder Legs, and resting their Belly upon them, as Hares and Conies.

Another.

They who have had a portion of it cut off, because it was corrupted by reason of a wound received in the *abdomen*, have afterward a weak concoction, and are enforced to cover the Belly well. See *Galen. lib. 4. de usu part. 9.* where he proveth this by example.

CHAP. VI.

Of the Gula.

THE Gullet being as it were the pipe or funnel of the Stomach, though it be seated in the *thorax*, and so should be considered in the next Book, yet because of its relation to the Stomach, being but an appendage of it, we shall treat of it here.

Its origine & descent.

It is an organical part, round and hollow, beginning

ginning at the root of the Tongue, behind the *larynx* and Windpipe, (where it is called *pharynx*) and passeth from thence directly between the Windpipe, the *vertebra* of the Neck, and the four first *vertebra* of the *thorax*, upon the which it resteth; but when it is come to the fifth *vertebra*, it giveth way to the trunk of the great Artery descending, by turning a little to the right side: afterward accompanying the Artery to the ninth *vertebra*, there it turns a little to the left again, and is raised up, by means of the Membranes, from the *vertebra*, and marching above the Artery, it passeth through the nervous body of the Midriff at a hole distinct from that of the great Artery, and is inserted into the left orifice of the *ventricle*, about the eleventh *vertebra* of the Breast.

It is properly called *σπαστήρ*, *quasi* σπῆς ὅτι κα- The names
στεῖς, *angustus* & *longus*: see *Aristot.* 1. *histor. ani-* of it.
mal. 16. It is also called *σπαστήρ*, *in* αἰνὴν τὴν σπῆν, *quod*
cibum ad ventriculum vehat.

It is framed of three Membranes. The first is *Its struc-*
the uttermost and common, compassing the two *ture.*
proper; this it hath either from the *peritoneum*,
according to some, or from the *pleura*, or from
the ligaments of the *vertebra* of the Neck and
Breast upon which it resteth. The second is the
middlemost, and it is fleshy and thick, for it con-
sists of two ranks of fleshy Fibres, (what Fibres
are see B. 5. ch. 1.) which ascend and descend ob-
liquely, and do mutually decussate one ano-
ther. This hath been held by many (not im-
probably) to be a kind of Muscle, because it is
sometimes affected with Convulsions and Palsies.
The third is the innermost, and it is membranous;

and hath onely small and straight Fibres. It is continued to that Membrane that covereth the Palate, Mouth, Jaws and Lips; whence the lower Lip usually trembleth, when one is going to vomit; and (according to Dr. Willis) it descends three fingers breadth below the mouth of the Stomach.

Vessels.

It hath Veins in the Neck from the Jugulars, in the *thorax* from the *vena sine pari*; but where it is joyned to the Ventricle, it hath some twigs from the *ramus coronarius*, which proceedeth from the *porta*.

It hath Arteries in the Neck from the *carotides*; in the *thorax* from the Intercostals, and in the *abdomen* from the *ramus celiacus coronarius*.

Nerves it hath from the sixth pair, which are carried obliquely, for safety, as *Galen* noteth, *l. 6. de usu part. 6.* and are very many.

Glandules.

It hath four *Glandules*; two in the Throat, which are called *Tonsilla*, or Almonds, common to the Gullet and the *Larynx*, which prepare and separate the pituitous humour to moisten them; other two it hath about the middle of it, towards the Back, about the fifth *vertebra* of the *thorax*, namely, where it gives way to the trunk of the *aorta*, and turns somewhat to the right side, or at that place where the *aspera arteria* is divided into two branches.

*The use of
it.*

The Gullet serveth as a funnel to carry meat and drink to the Stomach; for it receiveth them by dilating its proper internal coat, and turneth them down by the constriction of the middle coat, and the Muscles of the *Pharynx*. But concerning its action, and in what manner, and by what help swallowing is performed, see more fully and particularly

ticularly in the fifth Book, Of the Muscles, chap. 12.

CHAP. VII.

Of the Ventriculus or Stomach.

THAT part which we term the Stomach in English, in Latin is called *Ventriculus*, without any addition, to distinguish it from the other Ventricles, which have always some other word added to determine the signification, as *ventriculus cordis*, *ventriculus cerebri*. In Greek it is called *σπερ*, and *κοιλία*, from its Cavity. Its denomination.

In Man it is but one; but such quadrupeds as chew the Cud, especially all that are horned, have four Stomachs; the first whereof is called *μεγάλη κοιλία*, in English the *Paunch*; the second *κερύνεαλον*, in Latin *reticulus*; the third *χύνεον*, *omasus*, in English the *Feck*; the fourth *ἄνυστρον*, *abomasus*, in English the *Read*. Such Fowl also as live upon Corn have two Stomachs; the first membranous, called *ingluvies*, the *crop*; the second carnosus, called *ventriculus carnosus*, in English the *Gizzard*. Betwixt these two some name a third called *echinus*, but it seems rather a passage only betwixt these two than it self a distinct one. But this is not a place to be particular as to the differences of number or shape, &c. of the Stomachs of several Animals, having designed only a succinct Anatomy of Man. But the inquisitive may satisfy themselves in the learned Dr. Charleton's second prelection Number.

lection before the College of Physicians, entituled *Historia Ventriculi*; or more fully in the ingenious Dr. Grew's *comparative Anatomy of Stomachs and Guts*, published with his *Museum Regalis Societatis*.

Situation. It is placed immediately under the Midriff, which it toucheth; wherefore if it be too full it causeth a difficulty of breathing, by hindring the motion of it. In the forepart on the right side, it is covered with the hollow part of the Liver; on the left side it is touched by the Spleen; towards the Back by the *aorta*, the *vena cava*, and under it backwards by the *pancreas*: all which further its heat.

The bigness of it is commonly such, as is capable to receive so much food at one time, as is sufficient for nutrition. It is less in Women than in Men, to give way to the distention of the Matrix. They who have wide Mouths, have large Stomachs.

Connexion. It is joyned with the *gula* on the left side, where its upper orifice is: it is tied to the *duodenum*, where the lower orifice is, on the right side. The bottom in the whole length of it is joyned to the upper part of the Caul, by whose mediati- on it is joyned to the Liver, Back, Spleen, *Colons* and *Pancreas*.

Substance. The substance of it is membranous, that it might admit distention and contraction. It hath three Membranes. The first is common, which it hath from the *peritoneum* or the Diaphragm about the upper orifice; it is the thickest of all those which spring from the *peritoneum*; the Fibres of it being nervous are straight, running from one orifice to the other, and encompassing both

both its bottom and sides in their whole longitude. Near the orifices and towards the bottom of the Stomach, they are far thicker than in the middle, insomuch as there they seem in a manner carnos and motory. These nervous Fibres of this Membrane do cross at right angles the carnos ones lying next under them.

The second is fleshy, and the Fibres of it are transverse, under which a few oblique, and those fleshy, lie. This Coat is believed by some to be muscular.

The third is nervous, endued with all kinds of Fibres; straight, oblique and transverse; but the straight are most conspicuous and plentiful.

It is something wrinkled, and its inner superficies is pulpos, porous and soft. It is always moistened with a slimy flegmatick humour, that sticks so close to it, as if it were something that grew out of it.

Besides these Membranes with their Fibres it hath also a *parenchyma*, but that not sanguineous, but of a peculiar sort. For without a *parenchyma* how should the inequalities, that spring from the texture of the Fibres, be filled up? And what should that be, which those that make strings for musical Instruments, scrape from the Guts, if not it? for we see after such scraping they have lost nothing of their strength, which they owe to the Fibres and Membranes. And 'tis apparent that the substance of the Guts and Stomach is the same. Some there are that think this *parenchyma* that I plead for, to be almost wholly glandulous.

It hath also two *orifices*.

Orifices.

The one is in the left side, called *sinistrum*,
wider

wider than that in the right, that meat not well chewed might the better pass. It is called in Greek καρδία *cor*, from whence the region of the Stomach under the *cartilago ensiformis* is called *scrobiculus cordis*, or Heart-pit; and hence also the pains which happen in it are called καρδίαλαι, and καρδιαγγοι, because there is a great consent between it and the Heart, by reason that the twigs of Nerves which proceed from the same branch, springing from the sixth pair, communicate to both; so that one being affected primarily, the other must suffer by consent.

This hath orbicular Fibres, that the meat and drink being once received within the capacity of the Stomach, it might be exactly shut, lest fumes and the heat should break out, which might hinder concoction, and annoy the Head.

The other by the Grecians is called πύλωρ, *janitor*, or door-keeper, because it, as a Porter, doth makeway for the *Chylus* to descend to the *duodenum*: It is not so wide as the other orifice, because it was only to transmit the elaborate *Chylus*. Here the inmost nervous Coat is very full of wrinkles; the middle, which is carnosus, hath here also two ranks of Fibres; transverse or annular, to straiten this passage; and secondly straight, viz. such as running lengthways do gather up and draw the rest of the Stomach towards this door, for the distribution of the Chyle after it has been sufficiently concocted in the Stomach.

Its veins.

It hath Veins, first, from the trunk of *vena porta*, and this is *pyloricus ramus*; or, secondly, from the branches of the same, for so from *ramus splenicus* it hath *gastrica minor*, and *gastrica major* (the largest Vein of the Stomach) from whence

coronaria

coronaria springeth; *gastro-epiplois sinistra*, and *vas breve*: from the *ramus mesentericus*, before it be divided, it hath *gastro-epiplois dextra*. All these Veins, (as the rest of the Body) serve only to convey back again (towards the Heart) the remains of the arterial Blood which in the circulation is not spent on the refection and nourishment of the part; though some learned modern Anatomists think they do besides the arterial Blood receive some of the more subtile part of the Chyle for its readier conveyance into the mass of Blood, and thence draw a reason of the very quick refreshment that hungry and faint persons receive by eating or drinking.

It hath its Arteries from *ramus celiacus*, which *its arteries* do accompany every Vein, and have the same denomination with them.

It hath Nerves from the *par vagum*, or the *its nerves*. sixth pair (Dr. Willis's eighth) whose trunks passing down (below the pneumonick branch) by the sides of the Gullet are each divided into *two branches*, the *outer* and *inner*. Both the *inner branches* bending to one another grow into one, which passing with the Gullet through the Midriff goes on the *outer* part of the orifice of the Stomach, and spreads it self in its *bottom*. The *two outer branches* in like manner inclining to each other unite into one, which descending to the Stomach by the *oesophagus*, and arriving at the *inner* part of its orifice, there turns back and creeps through its *upper part*. The *inner* and *outer branches* as they come one on one side, and another on the other side of the upper orifice of the Stomach, send forth many small twigs, which mutually in-
osculating make there the *plexus nervens* like a net.

From

From this multitude of Nerves interwoven in the mouth of the Stomach proceeds that great consent betwixt it and the Head. (So that in any great concussion of the Head there follows a vomiting, and from the foulness of the Stomach the Head-ach, &c.) Here at this upper orifice, from the same reason, is the sense of hunger most urgent.

*The causes
of hunger.*

And this is a proper place to resolve the question, *What is the true cause of hunger?* To which I shall give *Diemerbroeck's* answer as the most probable. " It is caused from fermentaceous (or "dissolving) particles partaking of acrimony, bred " of spittle swallow'd and other saltish or acid " things eat or drunk, which sticking to the coats " of the Stomach, and brought to some acidity by " it, or remaining in it after the Chyle is sent off, " affix'd to its inmost wrinkled Membrane (especially about its upper orifice) molest it by their " twitching, which twitching being communicated " to the Brain by the Nerves of the sixth pair, an " imagination of taking meat is excited to allwage " that troublesome corrosion.] He that doubts of the truth of this opinion, may find it evinc'd at large in his *Anatome corporis humani*, cap. 6. p. 39, &c.

Its action.
Chylus.

The action of the Stomach is *Chylification*. Now *Chylus* is a white juice reasonable thick, like Barley cream, made out of the aliments taken ; the manner whereof is well exprest by the same Author. " While the meat is chewing in the " Mouth it is mix'd with the *saliva*, which not " onely softens it, but endows it with a certain " fermentative quality, unto which contributes " also the drink, (whether Beer, or Wine, or " some

"some other) which often contains in it acrimo-
 "nious particles and fermentaceous spirits.
 "The Stomach by the help of its Fibres embraceth
 "closely the meat thus chew'd and swallow'd,
 "and mixeth therewith specifick fermentaceous
 "juices, bred in its inner coat, and impregnated
 "with the *saliva*. Then by a convenient heat there
 "is made a mixture and eliquation of all; for that
 "the fermentaceous particles entering into the pores
 "of the meat, do pass through, agitate, and eliquate
 "its particles, dissolving the purer from the crass,
 "and making them more fluid, so that they make
 "another form of mixture, and unite among themselves
 "into the resemblance of a milky cream: after which,
 "together with the thicker mass, in which they are as yet
 "involv'd, by the constriction of the Stomach they
 "pass down to the Guts, where by the mixture of the
 "bile and the pancreatic juice, they are by another
 "manner of fermentation quite separated from the
 "thicker mass, and so are received by the lacteal
 "Vessels, as the thicker is ejected by stool.] See
 "further hereof in Dr. Charleton's third prelection
 "before the College of Physicians, *Seet. 6. p. 112.*

Of *figure*, it is round moderately; partly, *its figure.*
 that it should not take too much room; partly,
 that it might receive much. It is somewhat long,
 and hath two orifices higher than the bottom, lest
 if one should have been in the bottom, the aliment
 should have issued out of it unconcocted.

CHAP.

CHAP. VIII.

Of the Intestines, or Guts.

Their
name.

THE Guts are called in Latin *Intestina*, in Greek *Εντερα*, *Ἐν τῷ κοιλίῳ*, from their being placed within the Body.

Figure.

They are oblong, membranous, hollow, round, diversly twisted, continued from the *pylorus* to the *podex*, for conveying the Chyle, and the excrements of the first concoction.

Connexion.

They are knit together by the Mesentery, by which and by the intervention of the Caul (to which, part of the *Colon* is affix'd) they are tied to the back, and fill the greater part of the Cavity of the *Abdomen*, being sustained by the Cavities of the *os ilium*.

Substance.

They are of a membranous substance like the Stomach, thinner in the small Guts and thicker in the great; and the nearer they come to an end, the thicker they are, as the end of *Colon* and the *Rectum*.

Their
length.

The length of the Guts is about six times the parties length whose they are. They are thus long (and winding) that the concocted aliments passing out of the Stomach, by their long stay in the Guts, might the more commodiously be fermented by the admixture of the bile and pancreatic juice, and so the more subtile chylous parts being separated from the thicker mass, might be the better and more leisurely driven into the narrow orifices of the lacteal Vessels, partly by the proper peristaltick motion of the Guts, and also
by

by the impulsion of the Muscles of the *Abdomen* moved in respiration. And hereby two great inconveniencies are avoided ; the one of eating almost continually , which would have follow'd from the Chyles having not time enough to be elaborated and distributed , before it would have arrived at the *anus*, whereby the Body must needs receive but small sustenance from any thing eat or drunk ; the other (for the same reason also) of having almost a continual need of going to stool ; as happens to such voracious animals as have a streighter passage from the Stomach to the *anus*.

They have three coats, as the Stomach ; one *Common* and outermost from the *Peritonaeum*, but mediately ; for in the *Duodenum*, and that part of the *Colon* which cleaveth to the Stomach, it proceedeth immediately from the lower membrane of the Caul ; and in the *jejunum*, *ileum*, the rest of the *Colon*, *cacum* and *rectum*, it proceedeth from the membranes of the *mesenterium*. It is all over besmear'd with fat, and is truly nervous.

They have two *proper*. The outer, being the middle of the three , is carnous. It has two ranks of moving Fibres, one lying under the other ; The first and inner rank is annular or transverse , which encompassing the whole cavities of all the Intestines in very close order, is inserted into the hem or seam of the Mesentery as into its Tendon. The other rank is of streight Fibres, which being spread above the former, and cutting them at right angles, reach along the whole length of the Intestines ; and their Tendon seems to be the outmost coat, which be-

ing wholly nervous, or as it were tendinous, is rolled about the whole rank of these Fibres.

The innermost is nervous, although it seem to be fleshy, by reason of the crusty substance with which it is lined, which is framed of the excrements of the third concoction of the Guts themselves. This lining is called by *Pecquet* a spongy *peristoma*, by *Bilsius* a woolly moss; it serves as a Filtre for the Chyle to transcolate through in order to its entrance into the *vena lactea*; and besides, it hindreth excoriation, which might be caused when sharp humours pass through the Guts. Some (as particularly *Dr. Willis*) take it for a distinct coat, and call it *glandulosa tunica* or *villosa*; but I think 'tis only an *epiphysis* or excrescence upon the other, caused as abovesaid.

This Membrane in the small Guts, especially the *ileum*, is full of wrinkles, to stay the *chylus* from passing too soon; which wrinkles are caused, for that this inmost coat if it be sever'd from the other and the wrinkles stretcht open, will be (according to *Fallopini's* observation) thrice as long as it. And the same Membrane is expanded in the *Colon* into little cells, for the slower passing of the *faces*. It has all sorts of Fibres, and contains the mouths of all the Vessels both sanguineous and lacteal, which are cover'd with that spongy crust before-mentioned.

What was said of the *Parenchyma* of the Stomach in the foregoing Chapter, may without repeating it here, be applied to the Guts likewise.

Veins.

As to their Vessels, the Veins flow from the *Porta*, although not from the same branch: For the *duodenalis furculus* is sent into the *duodenum*, and

and the *Hamorrhoidalis interna* to the left part of the Colon near its ending, and thence running under the rectum is inserted into its end or anus; as the *dexter mesentericus* is sent to the jejunum, ileum, caecum, and the right part of the colon. *Epiplœis postica* is inserted into the middle part of the Colon, which marcheth transversely under the Stomach: besides these, a sprig from the *ramus hypogastricus* of the *vena cava* is sent to the Muscles of the *intestinum rectum*, which maketh the external *hamorrhoidal*.

The use of these Veins inserted into the Intestines the Ancients thought to be, both to carry venal blood to them for their nourishment, and also to receive the chyle out of them and carry it to the Liver there to be turn'd into blood. As to the first use, 'tis certain (by the circulation of the blood) that these Veins carry nothing to the Guts; but the blood in them, is all received from the Arteries there, to be carried back towards the Liver and so to the Heart: but as to the latter, there are some learned Anatomists that still think, though the greatest part of the chyle is received by the *vena lactea*, yet that some part is suckt in by these Veins, so to be more readily convey'd into the mass of blood. But this opinion is exploded by others as learned and more numerous, who deny any such office to them, whom I believe to be in the right. Besides these sanguineous Veins there are another sort of Veins inserted (more or fewer) into all the Guts, called *Lacteal*, but of them we will treat in a distinct Chapter.

The Arteries spring partly from *ramus coliacus Arteries*, *intestinalis*, partly from both the *mesenterica*. To

the *duodenum*, and the beginning of *jejunum*, a sprig is sent from the right *ramus celiacus*: but to the rest of the *jejunum*, to *ileum*, *cacum*, and the right part of *colon*, *mesentericus superior*; to the left part of *colon*, and to the *intestinum rectum*, *mesentericus inferior* is sent. This last passing along the *rectum* to the *podex*, makes the *internal hemorrhoidal Arteries*, as some branches from the *arteria hypogastrica* make the *external*. At the last, *epiplois postica*, which riseth from the lower part of *arteria splenica*, which is the left branch of *arteria celiaca*, is sent to the middle part of *colon*, which lieth under the Stomach. Their use is to convey nourishment and warmth to the Guts; and when the Body is morbose, to carry thither the impurities of the blood, upon a purge taken, or critically, so to pass out by stool.

The nerves. Nerves they have from the inferior ramifications of the *intercostals*. The *duodenam* hath some twigs from the upper branch of the *ramus mesentericus* called *stomachicus*, which go also to the *pylorus*. All except the *rectum* have many twigs from the *plexus mesentericus maximus*, arising from under the great gland of the Mesentery; but the *rectum*, with the latter end of *colon* receive slips from that branch of the *Intercostal* that is called *plexus abdominis infimus* or *minimus*; and the utmost extremity of the *Intercostal* is inserted into the *sphincter ani*, whither also pass three or four that spring from the bottom of *os sacrum*. These Nerves serve for the feeling, and the peristaltick or worm-like motion of the Guts; which though it be obscure and slow, yet because it is continual, it had need of so great a number of Nerves or nervous Fibres as are bestowed on the Intestines.

Intestines. The learned and curious that would be further informed about the peristaltick motion, may consult Dr. Glisson in cap. 15. of his Book *de ventriculo & intestinis*, or Dr. Charleton in Sect. 3. of his third prelection before the College of Physicians.

Though the Guts be one continued Body from the pylorus to the anus, yet from the thickness of their substance, also from their magnitude, figure, and variety of office they are distinguished into several by Anatomists, and first into thin, and thick.

The thin possess the umbilical region and hypogastrium; and in respect of their figure, situation, longitude and plenty of lacteal Vessels, they are divided into three, viz. the duodenum, jejunum and ileon.

The first is called duodenum, because it is thought to have twelve inches in length. It doth pass from the pylorus under the Stomach towards the Spine, and is sustained in its passage by the Membrane of the Caul, and not by the Mesentery. It reaches as far as the left Kidney, to which and to the vertebra of the Loins it is tied by membranous ligaments; and going a little lower it ends under the colon, where the anfractus or winding of the two following small Guts begins. It is thicker in its Membranes, but its passage (because streight) is straiter than theirs. Towards its lower end, sometimes higher, sometimes lower, it has most commonly two ducts leading obliquely into it; first the ductus choledochus communis by which the bile from the Liver enters this Gut; and secondly a little below this, ductus pancreaticus (otherwise Wirsungianus) by which the pancreatick

juice passes hither from the Sweet-bread : though these two ducts are sometimes joyned into one , and both open by one mouth into this Intestine. Sometimes, though rarely, they are inserted into the *jejunum*.

2. Jejunum.

The second is called *jejunum*, or the hungry Gut ; for it is for the most part found empty ; partly by reason of the multitude of milky Veins that enter it ; partly by reason of the fermentation of the acrimonious choler with the pancreatick juice, which are both poured in just before its beginning. In length it is twelve hand-breadths and three inches. It beginneth on the right side, under the *colon*, where the *duodenum* endeth, and the Guts begin to be wreathed ; and filling almost the whole umbilical region, especially on the left side, it tendeth into the *ileum*, from which it may be distinguisht first by its emptiness ; secondly by its greater number of Veins and Arteries, from which it looks reddish ; thirdly from the nearness of the folds or wrinkles of its inmost coat one to another, which are but about half an inch distant, whereas in the *ileum* they are a whole inch or more.

3. Ileum.

The third is *ileum*, derived *ἐκ τῆς ἑλίκου, à circumvolvendo*, from its many turnings and windings. It hath thinner Membranes than the rest of the *tenuia*. It is seated under the Navel, and filleth both the *Ilia*. It is the longest of all the Guts, for in length it containeth 21 hand-breadths ; but it is the narrowest of all, for it is not an inch in breadth. It hath fewer wrinkles than the *jejunum*, and lesser, which about the lower end of it scarcely appear.

It beginneth where both smaller and fewer Veins

Veins appear, and endeth about the place of the right Kidney, where it is joyned both with the *intestinum cecum*, & *colon*. It is easily distinguishable from the *colon*, for it is not joyn'd to it by a streight duct but transverse: For the *colon* and *caecum* are so united as to make one continued canal, whose lower side the *ileon* ascending pierceth, and into which its inner coat hangs loosely the length of half an inch at least, making the valve it self of the *colon*, and is the very limit that divides the *caecum* from it.

This *ileum* oft falls down into the Cod, whence such a rupture is called Intestinal. And in this Gut happens the distemper called *Volvulus* or *Iliaca passio*, wherein there is often vomiting of the dungy excrement. This distemper is caused herein, either when one part intrudes into another, or when 'tis twisted and twined like a Rope, or when it is stufft with some matter that obstructs it, or lastly when it falls out of its place into the *scrotum*, as was noted before. And thus much of the first sort of Intestines, viz. the *small* or *thin*.

Now follow the *intestina crassa*, the great Guts; they are three in number also.

The thick Guts.

The first is called *caecum*, *πελαδον*, the blind Gut, because one end of it is shut, so that at the same orifice the *chylus* (or *faeces* rather) passeth, and returneth. In Man it is about as thick and but half as long as your larger earth-worms stretched out at length; but its mouth that opens towards the *colon* is pretty large. It owes its origine rather to the *colon* than the *ileum*, and seems to be as it were an appendage to it. It is bigger in an Infant than in a Man. It is not tied to the

1. *Cacum*.

mesenterium; but being couched round, it is knit to the *peritoneum*, and by its end it is joyned to the right Kidney, the *peritoneum* coming between. In sound persons it is generally empty. In four-footed Beasts it is always full of excrements. Apes have it larger than a Man, Dogs larger than Apes; but Conies, Squirrels and Rats, largest of all, if you consider the proportion of their Bodies. Its use is very obscure in Men, being so very small and commonly empty. But in grown *fetus*'s or Infants new born it is full of excrement, for which it serves as a store-house till after the birth that they go to stool. And in such Animals as have it large, (according to Dr *Glisson*) it serves for a bag or second Ventricle, wherein the prepared aliments may be stored up, and so long retained, till a richer, thicker and more nutritive juice may be drawn from them.

2. Colon.

The second is *colon*, κῶλον, either *quasi* κῶλον *cavum*, because it is the hollowest or widest of the Guts; or else πρὸς τὸ καλύειν, *ab impediendo*, because it detaineth the excrements. It hath its beginning from both the *ileum* and *cacum*, transversely from the *ileum*, but directly from the *cacum*. It ariseth at the *os ileum* on the right side, and ascending by its Spine it arrives at the right Kidney; to which parts it is annex'd by a membranous connexion. From thence bending left-ways it creeps under the Liver by the Gall-bladder (which tinges it there a little yellowish) to the bottom of the Stomach; to the whole length whereof it is tied, only the Caul coming between, (as also to the *pancreas* and Loins.) Then it comes to the lower part of the Spleen, and is knit to

to it. Then touching the left Kidney, and adhering firmly to it by Fibres, it comes to the left *os ileum*; from which descending by the left Groin to the *pelvis* it embraceth the bottom of the Bladder behind on each side. Afterwards it ascends upwards by the right Groin near the place from whence it first took its rise; and thence marching back again towards the left side, and running it self in betwixt the *ileum* and Backbone it reaches to the top of *os sacrum*, and there unloads it self into the *rectum*. Its length according to Dr. *Gliffon* is about seven feet; others reckon it shorter. It goeth almost quite about the *abdomen* next to the Muscles, that it may be the better compressed by them for avoidance of the excrements. *Diemerbroeck* has an ingenious reason why it should pass under the Stomach, *viz.* That as Chymists judge no digestion more natural than that which is performed by the heat of dung, so the heat of the excrements in the *colon* does help the coction of the Stomach.

It hath cells which spring from the internal Tunicle of it: These cells are kept in their figure by a Ligament half an inch broad, which passeth through the upper and middle part of it all along; this being broken or dissolved, the cells stretch out and appear no more. Their *use* is to hinder the flowing of the excrements into one place, which would compress the parts adjacent; as also for the slower passage of the *faces*, that we may not have a continual and hasty need of going to stool. On its outside from its passing by the Spleen to its joyning to the *rectum* it has a great many fatty knots, which serve to moisten and lubricate it, that the *faces* may pass the more glibly.

The

The *rectum* also has such like, for the same reason.

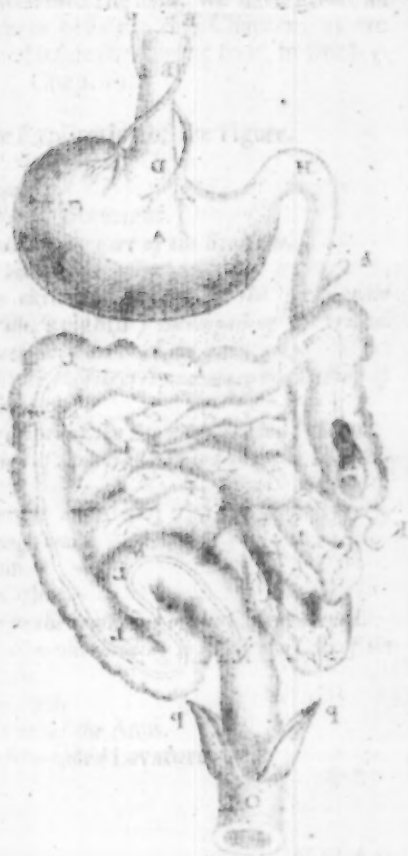
Its valve.

It hath a valve where it is joyned with *ilium*, (as was noted before) like to the *sigmoides* in the *sinus* of the Heart, as *Spigelius* compares it. This valve so stoppeth the hole which is common to the *ileon* and *colon*, that flatuofities cannot ascend to the *ilium*, much less excrements regurgitate. If one would find this out, let him pour water into the *intestinum rectum*, and hold up the Guts: The water will stay when it comes to the valve, if it be sound. If this valve be relaxed or torn by any means, excrements may regurgitate, and be expelled by vomit, and clysters also ascend up to the Stomach, as hath often happened in the Iliacal passion.

3. *Rectum.*

The third is *intestinum rectum*, the streight Gut: it hath its beginning at the first *vertebra* of the *os sacrum*, where the *colon* endeth; and passeth streight downwards to the extremity of the *coccyx*, and is fast tied on its *back-side* to both by the *peritoneum*, to keep it from falling out; and on its *fore-side* it grows in *men* to the neck of the Bladder, whence in the pain of the Stone there, there often happens a *teneismus* or continual inclination to go to stool; and in *women* to the neck of the Womb: but in both there is a musculous substance that comes between. It is a span in length, not so wide as the *colon*, but its Membranes are thicker. The Muscle *σφιγκτηρ* is at the end of it, which encompassing it round, purses it up close, so that nothing can pass out, unless it be relaxed voluntarily. This Gut (especially its inner Membrane) usually bags a little out in straining at stool, yea sometimes so much, that it requires an artificial putting up again.

As





As for the hemorrhoidal Veins and Arteries, that are inserted into the *anus*, we have given an account of them before in this Chapter; as we shall do of the Muscles belonging to it, in Book 5. of the *Muscles*, Chap. 19.

The Explication of the Figure.

- A The Stomach.
- B The Gullet or Oesophagus.
- C The left and larger part of the Stomach.
- D The upper orifice of the Stomach.
- E The right external Nerve of the sixth pair
(Dr. Willis's eighth) encompassing the orifice.
- F The left external Nerve of the same pair.
- GG The gastrick Vessels creeping along the bottom of
the Stomach.
- H The lower orifice of the Stomach, called Pylorus.
- h The insertion of the Gall-passage into the Duode-
num.
- III The Jejunum and Ileum with the Vessels creep-
ing along them.
- K The Cæcum.
- LLLL The Colon.
- M The valve in the beginning of the Colon opened.
- mmmm The Ligament holding together the Cells of the
Colon.
- NN The Rectum.
- O The Sphincter of the Anus.
- PP The Muscles called Levatores Ani.

CHAP. IX.

Of the Mesenterium.

*Its denomi-
nation.*

THE *Mesentery* is so called from its situation. For it has its Greek name *μεσεντερον* (from whence the English is derived) from its being placed *ἐν μέσῳ τῶ ἐντέρον*, in the midst of the Intestines. And it is a membranous part, situated in the middle of the lower Belly, serving not only for conveying some Vessels to the Intestines, and others from them, but also it ties most of the Guts together so artificially, that for all their manifold windings they are not entangled and confounded. Which may be much wondred at, how the Guts being about nine or ten yards long should all but the *duodenum* and a piece of the *rectum* be comprehended by that circumference that is but a span distant from the centre ; for no longer is the Mesentery betwixt those bounds. But it is almost of a circular figure, which is most capacious ; and though it be narrow at its rise, (which is double, viz. at the first and third *vertebrae* of the Loins) yet its circumference is wrinkled and enlarged into so many folds, as to be three ells in length, whereby it comes the nearer to answer the length of the Guts, and to keep them within a small compass and place likewise.

Substance.

It is framed of two common Membranes, which it has from the duplicature of the *peritoneum* ; and betwixt these two it has a third Membrane that is proper, (which was first discover'd by Dr. Whar-

Dr. Wharton in a young Maid) and is thicker than either of the other two, wherein the glands are seated and by which the Vessels are conducted.

The parts contained in the Mesentery are either common or proper. The common are Veins, Arteries, Nerves and Lympheducts. The proper are Glands and the *Vena lactea*. Of these last we shall speak in the next Chapter, of the rest here.

The Veins are called *Mesaraica*; these spring from *ramus mesentericus dexter & sinister*, branches of the *vena porta*. (Their use, as also that of the Arteries, was shewn in the Chapter before, speaking of the Vessels belonging to the Guts.)

It hath also two Arteries, the one superior, the other inferior, branches of the *arteria mesenterica*, which pass as the Veins do.

As for the Nerves, Dr. Willis describeth them very accurately in his Book *de Cerebro*, cap. 25. which take thus in short. As soon as the *intercostal pair* is descended as low as over against the bottom of the Stomach, it sends forth on each side a large mesenterick branch, each of which is again divided, and makes two *plexus* in each side. In the middle of these is the greatest *plexus* of all, which (as he speaks) is like the Sun amongst the Planets; from which twigs and numerous Fibres are dispersed into all the parts of the Mesentery, which accompanying the sanguiferous Vessels in their whole process, do climb upon them and tie them about.] Others it hath from those which spring from the *spinalis medulla*, between the first, second, third and fourth *vertebra* of the Loins, (as *Spigelius* affirmeth.)

Besides

The ANATOMY

Besides these Vessels known to the Ancients ; about 30 years agoe there were found out another sort by *Tho. Bartholin* (a learned *Dane*) and called by him *vasa lymphatica*, which he gives a large account of in *Append. 3. to the libel. 1. de Venis*, of which I shall give a *compendium* here , because the Mesentery abounds with them.

They are of figure long and hollow like a Vein, but very small and knotty , having very many valves which permit the *lymphe* or water contained in them to pass to the chyliiferous Vessels (and many Veins) but hinder its return. They are of a pellucid and crystallin colour, like *hydatides*, consisting of a transparent and most thin skin, which being broken and the *lymphe* flowing out, utterly disappears. Their number cannot be defin'd, for they are almost innumerable. As to their rise *Bartholin* speaks uncertainly, but *Steno* and *Malpighius* both declare that they always proceed from Glands. As to their insertion or ending, those under the Midriff do discharge their liquor into the *receptaculum chyli* (to be spoken of in the next Chapter.) Those in the *thorax*, immediately into the *thoracick duct*. And those of the Neck, Arms, &c. into the jugular vein. *Bartholin* thought they all discharg'd themselves into these three channels : but *Diemerbroeck* affirms they open also into many other Veins ; and quotes *Steno* noting that they empty themselves into the jugular and other Veins ; and also his Countryman *Frederick Ruysch* writing that by ligation and structure of the Valves he has plainly seen, that all the lympheducts in the Lungs do discharge their *lymphe* into the subclavian, axillar and jugular Veins. There has been much dispute
what

what this *lympba* which they carry, is. *Bartholin* thinks it to be the simple superfluous *serum* of each part, brought thither by the Arteries. *Gliffon*, that it is a liquor condens'd from the *halitus* of the blood (like dew) driven into these Vessels, and flowing back with the vehicle of the aliment brought by the Nerves. *Sagerus* (and *Sylvius*) that it is the animal spirits, or is made of them, which after they are distributed into all parts by the Nerves, are there partly consum'd and dissipated, and are partly condens'd into this water. *Diemerbroeck* quotes more opinions besides these, but rejects them all, and establisheth this of his own: *viz.* That it is a fermentaceous liquor separated from the serous part of the blood in the conglobate Glands, yet not simple, but impregnated with much fus'd and volatile salt, and also with some sulphureous particles; which when it is conveyed to the *vasa chyliifera*, makes the chyle thinner, and apt to dilate easily in the Heart; and when to the *Veins*, prepares the venous blood (now too thick) for a quick dilatation in the Heart.] This *lympba*, whatever it be, (or be for) differs from the *serum*; for if one gather a little of it in a spoon, and let it stand, without setting it on the fire, it will turn to a gelly, which the *serum* will not doe. And thus much of the *Lympheducts* (with their *lympba*) in general; as to those particularly of the Mesentery, some only pass through it from other parts, as the Liver, &c. but many have their rise in it, and both the one and other are emptied into the *receptaculum chyli*.

It hath many little softish Glands fix'd in its *Glandules*.
proper Membrane, cover'd on each side by the
two

two common ones, and beset with fat. In number they are very uncertain; in Man fewer than in other Creatures. The biggest by much is at the rise or center of the Mesentery, (called by *Afelius, pancreas*) into which all the *vena lactea* are inserted. Of its use, as also of the lesser, we shall speak in the next Chapter, when we come to treat of the passage of the Lacteals. We will only note here, that when these Glands grow scirrhus, or are any ways obstructed, so that the Chyle cannot transcolate through them, there follows a *fluxus celiacus*, or *chylosus*, which continuing there ensues an Atrophy, and the party dies tabid.

Fat.

The fat with which it is stufft betwixt its Membranes, though it happen naturally to it, yet ought not to be reputed a proper part of it. For not to mention that in Dogs, Cats, and such like Animals this part is very thin and transparent, even in humane *Embryo's* it is without fat; and in very lean Men there is but little, though in fat Men it be heaped up to so great a thickness.

Division.

It is but one, yet because of its different thickness it is divided by some into two parts.

The one they call *Mesaraum*, *μῆστρον*, because it is placed *ἐν μέσῳ τῆς σφαῖρας* (*subaudi ἐν τέρει*) in the midst of the small Intestines, which it knits together; and this is the thicker part of it. The other being the thinner they call *κοιλιακόν*, being seated *ἐν μέσῳ τῆς κοιλίας*, in the midst of the *colon*, to which it is joyned in its whole length save only in the *colon's* passage under the Stomach; and in its lowest border it adheres to the *rectum*.

Diseases.

Diseases incident to this part are reckoned up by *Dr. Wharton* to be these; those of *intemperies*,
strait-

straitness or obstruction, tumours of whatsoever kind, (*Scirrhi, Scrophulae, Struma*) Inflammations, Abscesses, Ulcers, and Tone vitiated. Of all which the Reader that desires fuller information, may be satisfied by the said learned Author, in his *Adenographia*, cap. 11.

CHAP. X.

Of the Venæ lacteæ, Receptaculum Chyli, and ductus chyliferus Thoracicus.

V*Ena lactea*, the *Milky veins* (so called from the *Their* white colour of the Chyle which they carry) *name.* were not discover'd (as such) till the year 1622. when *Caspar Asellius* found them out in dissecting a Live-dog well fed. But since him many others have made a more accurate discovery of them. They are slender pellucid Vessels, having but a single Coat, dispersed through the Mesentery, infinite in number, appointed for the carrying of the Chyle.

They spring out of the Intestins, into whose *Rise.* inmost Membrane their Mouths are inserted, which are hid under a kind of a spongy crust or *mucosa*, through which by the pression of the Guts the Chyle is strained and received by the mouths of these vessels. Presently after their rise they aim to that nearest part of the Mesentery, where-to the Intestine from which they arise, is knit. Then they go the readiest way to such Glandules of the Mesentery as are nearest to them: but in
E their

their passage sometimes many little branches meeting grow into one great trunk ; namely, before they insinuate themselves into the Gland, to which we said they were going. But in their very entrance into the Glands, or a little before, this trunk separates again into new branches, more and smaller than the other, which are obliterated in the very substance of the Gland. Out of the Gland there spring again new capillary Veins, which by and by meeting together make one trunk again as before : which being carried towards the beginning of the Mesentery, in their march joyn to themselves others of the same kind meeting them, and so grow larger and larger, and at last very many enter into the great or middle Gland of the Mesentery (called improperly *Pancreas*) in the same manner as they enter'd the smaller, and some pass by over its *superficies*, and by and by they all empty themselves into the great or common receptacle of the Chyle, that lies under the said Gland, those that were inserted into it rising out of it, as was before spoken of the lesser Glands.

Bartholin says that behind the great Gland there are three other smaller (which he calls *Lumbares*) into which the Lacteals are inserted, but assents to *Dr. Wharton*, that from them they pass to the *Receptaculum*.

Recepta-
culum
chyli.

This common Receptacle is called *Receptaculum Chyli Pecquetianum*, from *Pecquet* who first found both it and the *ductus Thoracicus* (whose beginning it is) about thirty years ago. It might as well be called *receptaculum Lympha*, for that the *Lympha* passes not only with the Chyle, but after this is all distributed, the *Lympha* still continues to glide

glide into it, and to ascend by the *ductus chyliferus Thoracicus*, which might be called *Lymphaticus* for the same reason. This Receptacle is seated under the *Cœliack* artery and Emulgents at the *vertebra* of the Loins, whence there springs a duct that presently enters the Diaphragm with the *Arteria magna*, where (being now enter'd the *Thorax*) it begins to be called *ductus Thoracicus*. And now though it be past out of the *Abdomen* (of the contents whereof we are now treating) yet we will trace it through the middle Ventricle to the Heart whither it conveys its liquor, for the same reason that being to speak of the Stomach, we thought it best to speak of the Gullet, which is an appendage to it, and by which the meat descends into it.

This Duct then having past the Midriff, it marches further upward under the great Artery till about the fifth or sixth *vertebra* of the *Thorax*, where it turns a little aside from under the great Artery to the left hand; and so below the intercostal Arteries and Veins, under the *Pleura* and gland *Thymus*, it ascends to the left subclavian Vein, into whose lower side it opens, just there where the left Jugular Vein enters into it on the upper side, so that their Mouths face one another. But it opens not into this Vein with any large orifice, but by six or seven little ones, being all cover'd together in the interior Cavity of the *Subclavia* with one broad valve, looking towards the *Cava* from the Shoulder, whereby there is granted to the Chyle and *Lympha* a free passage out of the *ductus Chyliferus* into the *Subclavia*, but their return (or of Blood with them) out of the Vein into the Duct is prevented. This Duct ending thus

*Ductus
chyliferus
thoraci-
cus.*

in the subclavian Vein, the Chyle that it conveys into it passes with the Blood (returning by the *Cava*) into the right ventricle of the Heart, where we will leave it, and return to the *Vena lactea* again; having only observed, that this Duct has many Valves that hinder the ascending Chyle and *Lympha* from returning down again; which Valves are manifest by this, that the Chyle contained in the Duct may easily by the finger be pressed upwards, but by no means downwards; or if one make a hole in it, the liquor tending from beneath upwards will flow out at it, but that which is above it, is so stopt by the Valves, that it cannot be made to descend by it. And now for the *Vena lactea* of the Mesentery.

The difference between the *Vena lactea* and the ordinary mesaraical Veins.

They differ from the ordinary mesaraical Veins, First, in bigness; for these are bigger, but those are more in number; for they are more than twice as many: for more *Chylus* must pass by them, the way that has been spoken, to make Blood of, for the nourishment of the whole Body, than there can be Blood remaining from the nourishment of the Intestins only to return by the Mesaraicks to the Liver.

Secondly, they differ in colour, by reason of the great difference in colour of their contained liquors. The Lacteals are white and limpid by reason of the whiteness and clearness of the Chyle which they contain; but the sanguinary Veins are of a dusky blackish colour.

Thirdly, they differ in their insertion; for the Lacteals, as has been said, are inserted into the great gland of the Mesentery called *Pancreas*, but the Mesaraicks all terminate in the Liver.

They have a pretty many Valves, but not so many

many as the *ductus Thoracicus*. They may be dis- *Their*
cover'd the same ways as we intimated those of *Valves*.
the *Ductus* might; viz. that if they be pressed to-
wards the great Gland, they are presently empti-
ed; but if one press them from the Gland to-
wards the Intestins, the Chyle will stop and can-
not be driven thither.

That the Ancients did not find out these Veins, *Why the*
the cause was, either because they only dissected *Ancients*
Beasts after they were dead, or after that the *did not*
Chylus was distributed, or they did not presently *find these*
take a view of the Mesentery; but made some *out.*
stay about the inspection of some other part.

CHAP. XI.

Of the Liver.

THE Liver is seated in the upper and chief *Its situati-*
place of the *Abdomen*; namely about a fin- *on.*
gers breadth distance from under the Midriff, in
the right Hypochondre, (under the short Ribs)
which, being of a great bulk, it even fills, and
reaches from thence towards the left side, a little
beyond the *Cartilago ensiformis*, or pit of the Sto-
mach. Its upper part is convex or round and
smooth, the lower side is hollow, lying on the
right side of the Stomach and *Pylorus*, &c. Its
lower edge reaches below the short Ribs (in a
healthfull Man when he stands upright) and al-
most to the very Navel.

In Dogs and many other Brutes it is divided *Lobes,*
into divers Lobes, but in Man it is continuous;

only there is a little protuberance in its hollow side, whereby it is tied to the Caul, which *Spigelius* called a Lobe, and from him others, but it is improperly called so, and not at all like the Lobes in the Livers of Brutes.

Ligaments. It has three Ligaments (properly so called) which according to Dr. *Glisson* (*de Hepate*) are these. The first is called *Suspensorium*, for it ties up the Liver to the Diaphragm; it is broad, membranous and strong, arising from the *Peritoneum*, and is not only fixed to the outer membrane of the Liver, but does indeed make it, and descends even into it, and is strongly fastned to the common sheath or *involucrum* of the *Vena cava* (there where the umbilical Vein is continuous to it.) By this strong insertion it is the more able to bear up the great weight of the Liver.

The second is the *Vena umbilicalis*, which after the birth, closes up and hardens into a Ligament. It is directly opposite to the former. It passes out of the fissure of the Liver and terminates in the Navel. By this the Liver is kept from ascending upon the motion of the Diaphragm upwards in respiration.

The third is that whereby the Liver adheres to the *Cartilago ensiformis*. This is thin and flaccid, but yet strong, broad and doubled, arising from that Membrane wherewith the Liver is encompassed, (according to *Spigelius*) of which it is a duplicature (according to Dr. *Glisson*.) This hinders it from fluctuating to one or t^other side, or towards the Back.

Besides these three Ligaments, it has several other connexions to the neighbouring parts, but they would improperly be called Ligaments.

Thus

Thus it is connected to the *Vena cava*, and *Porta*, to the *Caul*, and to several other parts either mediately or immediately.

It is covered with a very thin Membrane, which springeth from the first Ligament, (as was said before) which cleaveth firmly to the substance of the Liver. If it be separate at any time by a watrish humour, issuing out of the capillary Lymphaticks, watrish Pustules, by the Græcians called *υδανιδες*, are ingendered. If these break, the water falleth into the cavity of the Belly, and causeth that kind of Dropsie called *Ascites*.

Its substance or *Parenchyma* is red and soft, almost like concreted blood, and may, when it is boiled, be easily scrap'd or brusht off the vessels. But though its *Parenchyma* look red, that is only from the great quantity of blood that is poured into it from the *Vena porta*: for its proper colour is pale, a little yellowish, such as the Liver is of when 'tis boil'd; and yet that yellowishness seems to be caused by the Bile passing through it; so that *Malpighius* thinks white to be its proper colour, and gives a far different account of its *Parenchyma* from others, whose observations by the Microscope *Diemerbroeck* thus represents (out of *Malpig. lib. de Hepate, cap. 2.*) "That 1. The substance of the Liver in Man is framed of Lobules, and these are compounded of little Glands like the stones of Raisins, which look like bunches of Grapes, and are cloathed with a proper circumambient Membrane— 2. That the whole bulk of the Liver consists of these little grape-stone-like Glands and divers sorts of Vessels; and hence, that they may perform together a common work, it is necessary that

“there be a commerce betwixt these Glands and
 “Vessels. 3. That the little branches of the
 “vessels of the *Porta*, *Cava*, and *Porus biliaris*,
 “do run through all even the least Lobules in an
 “equal number; that the branches of the *Porta*
 “do the office of Arteries, and that the *Porta*
 “has so great society with the *Porus biliaris*,
 “that both their twigs are straitly tied together
 “in the same cover. 4. That the shoots of the
 “said Vessels are not joyned by Anastomoses, but
 “that the grape-stone-like Glandules, making
 “the chief substance of the Liver, are a medium
 “between the importing and exporting Vessels,
 “so that by the interposition of these, the impor-
 “ters transfuse their liquor into the exporters.
 “From these observations he concludes the Liver
 “to be a conglomerate Gland, separating the
 “Bile—— and because it is usual for the con-
 “glomerate Glands to have, besides Arteries,
 “Veins and Nerves, a proper excretory Vessel
 “(as in the *Pancreas*, &c.) dispersed through
 “their substance, and drawing out and carrying
 “away the humour designed for them, this kind
 “of Vessel in the Liver is the *Porus biliaris* with
 “the Gall-bladder.] And this is a very proba-
 “ble account of it.

Veins.

It hath two sorts of Veins. In its upper part
 the *Vena cava* entreth into it, and spreads it self
 all through it in the lower as well as upper part.
 Into the lower side the *Vena porta* is inserted,
 whose branches likewise run through its whole
Parenchyma. Of both these Veins more fully in
 the two following Chapters.

Arteries.

It has but very small and few Arteries, for the
Porta serves it for an Artery, bringing blood to
 it.

it. Those which it has, do all arise from the right branch of the *Arteria celiacæ*, (called *hepatica*) there where it is joyned to the *Vena porta*, whence being sustained by the coat of the Caul it ascends to the hollow of the Liver just by the *Porta*, on whose coat, with the biliary Vessels, and the membrane of the Liver, it is wholly spent. For as was said, the *Parenchyma* is nourished by the blood brought by the *Porta*.

It has Nerves from the Intercoastal pair, name- *Nerves*.
ly one from the stomachical branch thereof, another from the mesenterical (called *hepaticus*.) But the Nerves are extended only to the Membrane and vessels of the Liver, (as the Arteries were) so that the *Parenchyma* has but a very dull sense.

Till the *ductus Thoracicus Chyliferus* was found *Lympho-*
out, it was still believed that the *Vena lactea* were *ducts*.
inserted into the Liver, which was looked upon as the great organ of sanguification; but now 'tis known for certain that no *Lactea* at all go to the Liver, but that those vessels which were taken for such, are Lymphatick vessels carrying from it a most limpid and pellucid juice. That they are dispersed in the *Parenchyma* of the Liver, has not yet been observed; but it is very probable that they arise from its Glands, and coming out of its hollow or lower side, with the *Porta*, they encompass it round as also the *ductus Communis*, passing mostly towards the Mesentery; and under the *Vena cava* near the *Pancreas* (that is knit to the Stomach and *Duodenum*) a great many do pass over a certain Gland (sometimes two or three) lying under the *Vena porta* and often adhering to it, and from thence with many others passed by the Gland, they open themselves into the

the *receptaculum Chyli*. That these vessels bring nothing to the Liver, and so cannot be Lacteals, is apparent; for if in a Live-creature you make a Ligature betwixt the Stomach and Liver, in that part of the Mesentery that knits the Liver to the Stomach and Intestins (in which Ligature let the *Vena porta* and *ductus Communis* be comprehended) these vessels will presently swell betwixt the Ligature and the Liver, but be empty on that side towards the *receptaculum Chyli*; and the same is evident from their Valves also which open towards the said Receptacle, but hinder any thing from coming back from thence to the Liver.

The biliary
Vessels.

Whether
the Liver
sanguifie.

Concerning these we shall forbear to speak here, designing a particular Chapt. for them, viz. ch. 14.

Hippocrates in lib. 4. de Morb. says, The fountain of blood is the Heart, the place of Choler is in the Liver; This comes very near the truth, as shall appear hereafter. But from Galen downwards it was generally held that the Mesaraick Veins received the Chyle from the Guts and brought it to the Liver, where it was turned into Blood, and carried from thence into all the parts of the Body by the Veins. Yea and after the *Vena lactea* were found out, they would needs have them to terminate in it, thinking it the fittest Bowel for sanguification, and presuming that that task must be performed by some or other. It would be needless here to stand to confute these opinions, now that all the world is convinc'd of their falsity, and by what hath been already said they may sufficiently appear to be erroneous, no Chyle at all coming to the Liver. How and where sanguification is performed, we shall shew when we come to the Heart, and here we shall declare the true use of the Liver.

The

The Liver then being discharged from sanguification, it serves to separate the Bile from the Blood brought plentifully to it by the *Vena porta*. Concerning the nature of this Bile there have been divers opinions. The Ancients (amongst whom was *Aristotle*) thought it to be a meer excrement, and to be of no other use than by its acrimony to promote the excretion of the Guts. And this opinion prevail'd so long as it was believ'd that the Liver had a nobler action than to transcolate this Choler. But now it being found out that it has no other office, it is believ'd that so bulky a Bowel was never made for the separation of a *meer excrement*, and therefore they think it to be a *ferment* for the Chyle and Blood, whereby if they were not attenuated and prepared, they could not be enspirited in the Heart. This new doctrine I shall give entirely out of *Diemerbroeck*, p. 154. " The venous Blood flowing into " the Liver by the *Porta* out of the Gastrick and " Mesaraick veins (and may be a little by the " Hepatick artery) is mixed with an acrimoni- " ous, saltish and subacid juice, made in the " spleen of the arterious blood flowing thither by " the Arteries, and of the animal spirits by the " Nerves, which is brought into the *Porta* by the " *ramus Splenicus*. Now both these being entred " the Liver by the branches of the *Porta*, by " means of this said acrimonious and acid juice, " and the specifick virtue or coction of the Liver, " the spirituous particles, both sulphureous and " salt, lying hid in the said venous blood, are " dissolved, attenuated, and become also a little " acrimonious and fermenting; a certain thin- " nest part whereof, like most clear water, being " sepa-

*The action
of the Li-
ver.*

" separated from the other thicker mass of the
 " Blood by means of the conglobated Glands,
 " plac'd mostly in the hollow side of the Liver, is
 " carried from thence by many Lympheducts, as
 " has been said. But the fermentaceous spirits
 " of greater acrimony, mixed with the thicker
 " and more viscid sulphureous juices (for Sulphur
 " is viscid) and more strongly boiling, whenas
 " through the clamminess of the juices in which
 " they inhere, they cannot enter the conglobated
 " Glands nor from them the Lympheducts, and
 " through their fierce ebullition are separated
 " from the Blood (as Yest from Beer) these fer-
 " mentaceous spirits I say being sever'd with the
 " juice in which they inhere, become bitter and
 " are called *Bile*. Which *Bile* being transcolat-
 " ed through the grape-stone-like Glandules into
 " the roots of the *porus Biliaris* and of the Gall-
 " bladder, passes through them by the *ductus*
 " *Communis* into the *Duodenum* or *Jejunum*, where
 " it is presently mixed with the pancreatick juice,
 " and both of them with the alimentary mass con-
 " cocted in the Stomach, and now passing down
 " this way, which it causes to ferment. And be-
 " cause at its first entrance it is more acrimoni-
 " ous, and has its virtue entire, and so causes the
 " greatest ebullition with the pancreatick juice,
 " hence the milky juice contained in the mass
 " concocted in the Stomach, is most readily and
 " in greatest quantity separated in the *Jejunum*,
 " and by innumerable Lacteal vessels, (which are
 " more numerous in this than the other Guts) it
 " is most quickly driven on towards the *receptacu-
 " lum Chyli*, and this is the reason that this Gut
 " is always so empty. But in the following Guts
 because

"because the fermentaceous spirits are a little
 "pall'd, the effervescency becomes slower and
 "less efficacious, and the Chyle is more slowly
 "separated from the thicker mass, and therefore
 "they have fewer *Vena lactea*. At length what
 "remains of this fermenting matter is mixed
 "with the thick *faces* in the thick Guts, where
 "by its acrimony it irritates them to excreti-
 "on.] Thus far that perspicacious and judi-
 cious Anatomist. And this I think is the best
 account hereof that has been given.

CHAP. XII.

Of the *Vena portæ*.

THough it be the method of Anatomists usu-
 ally to deliver the doctrine of all the Veins
 in a distinct Chapter or Book after the descripti-
 on of the three Ventricks; yet seeing all the
 Veins seem (and by the Galenists have been as-
 firm'd) to have their root in the Liver, of which
 therefore we cannot but take notice; on this ac-
 count we will also describe their branchings with-
 in the *Abdomen*, seeing they are parts contained
 in it. And we will begin with the *Vena portæ*.

It is so called from the two eminences (called *Its name.*
 by *Hippocrates* *πύλαι*, *Portæ*, Gates) betwixt
 which it enters into the lower side of the Liver.

Some think that the *Vena umbilicalis* ought to *Origine.*
 be accounted its root or original, because it is first
 formed in the *Fetus* and inserted into the *Portæ*.
 But this umbilical Vein after the birth ceasing
 from

from the office of a Vein, and degenerating into a Ligament, though it might be accounted its root then, it cannot properly now. Others think, that because its branches every where inserted into the Intestins bring blood from thence to the Liver, (and not *vice versa*) therefore those ought rather to be accounted its roots, and its divisions within the Liver its branches. And indeed strictly and properly they ought to be accounted so, but however we shall not think it absurd to speak with the Ancients, who because they thought the *Porta* carried blood from the Liver to the Guts for their nourishment, suppos'd the Liver to be its root.

As it enters into the Liver, it is invested with another Coat, which some call *Vagina porta*, its Sheath, others *Capsula*, its Case, and *Capsula communis* because the *Porus biliaris* is involved in it as well as the *Porta*. This outer Coat it has from the membrane of the Liver, (as that is from the *Peritoneum*) that is, it is continued from it, though it be of a clear other substance, namely more dense and carnos. It is invested with it in all its ramifications, and so having a double Coat is in that respect an Artery, as also in that it brings blood to the Liver for its nourishment as well as for other uses, and lastly in that by means of the *Arteria hepatica* inserted into the *Capsula* it has an obscure pulsation (according to Doctor *Glisson*.)

*Branchings
in the Li.
ver.*

When it is enter'd about half an inch into the Liver, it is carried partly to the right hand, partly to the left, and so is shap'd into a *Sinus* as it were, and thence is divided into five large branches, four whereof are diffus'd all over the hollow side of the Liver, but the fifth ascends
streight

freight to its upper side where it disperfes it self. And the said *Sinus* is more conspicuous in an *Embryo*, because the great influx of nutritious juice out of the Umbilical vein enlarges it much. Moreover in an *Embryo* you may easily see the *Tubulus* or *Canalis venosus* passing directly out of this *Sinus* into the *Cava* (almost opposite to the mouth of the Umbilical vein.) This *Canalis* or Pipe is of the same substance and texture with a Vein, and enters into the *Cava* just where it is knit to the Diaphragm ; and there also two other great branches out of the Liver are inserted into the *Cava* ; and in the same place this Pipe is also knit to the suspensory Ligament spoken of before, and after the Child is born grows it self into a Ligament, being in a manner opposite to the umbilical Ligament. But to return to the divisions of the *Porta*. The Ancients taught that they were only spread in the simous or hollow part of the Liver, but Dr. *Glisson* in his accurate Anatomy of it, affirms the *Porta* to be disperfed very equally in all its parts, upper as well as lower. And whereas it has been a constant doctrine, that the branches of the *Porta* open by anastomoses into those of the *Cava*, the same learned Author, and many others since him, have observed that there are no such anastomoses at all, but that the blood doth ouze through the glandulous *Parenchyma* of the Liver out of the Capillary veins of the *Porta* into those of the *Cava*. He that would be fullier informed hereof, may consult his most accurate Book *de Hepate*. But we will now pass to the branches of the *Porta* gone out of the Liver.

This Trunk parting a little from the Liver, before it be severed into branches, puts forth

*Its branches with-
out the Li-
two ver.*

two twigs, out of its upper and fore-part, which are inserted into the *Cystis fellea* or Gall-bladder (and are from thence called *Cystica gemelle*) about the neck of it, and spread by innumerable twigs, through the external coat of it.

A third twig also that is bigger, but lower, springeth from this same fore-part, yet towards the right side, and is inserted into the bottom of the Stomach: from hence it sendeth many sprigs toward the hinder-part of it, towards the Back. This is called *Gastrica dextra*.

Having sent forth these three twigs, the Trunk passeth down, and bending a little towards the left side, it is parted into two remarkable branches; whereof the one is called *sinister*, or the left, seated above the right, but is the lesser: the other is *dexter*, or the right, lower than the left, yet larger. The left is bestowed upon the Stomach, the *Omentum*, a part of *Colon*, and the Spleen; the right is spread through the Guts, and the *Mesenterium*: the left is called *Vena splenica*; but the right *Vena mesenterica*.

Vena splenica.

The *Vena splenica* hath two branches before it come to the Spleen, the superiour and the inferiour.

The superiour is called *Gastrica*, or *Ventricularis*. This is bestowed upon the Stomach; the middle twig compassing the left part of its orifice like a garland, is called *Coronaria*. From the inferiour branch two twigs do spring; The one is small, and sends twigs to the right side of the lower membrane of the *Omentum*, and to the *Colon* annexed to it. This is called *Epiplais*, or *Omentalis dextra*. The other is spent upon the lower membrane of the *Omentum* which tieth the

Colori

Colon to the Back, and upon that part of the Colon; it is called *Epiplois*, or *Omentalis postica*.

When the *Ramus splenicus* hath just approached to the Spleen, it doth send out two other twigs, the uppermost and the lowermost. The uppermost is called *vas breve*, and is implanted into the left part of the bottom of the Stomach.

This Vein the Ancients believed to carry an acid juice from the Spleen to the Stomach to stir up appetite and to help the fermentation of the meat; but it is certain both by Ligature (whereby it filleth towards the Stomach and emptieth towards the Spleen) and also by the general nature of Veins, whose smaller branches and twigs still receive the superfluous arterial blood from the part whereinto they are inserted, into the larger chanel, and conduct it towards the Heart; I say it is certain from hence, that this same *vas breve* carries nothing to the Stomach, but only brings from thence into the *Ramus splenicus* the remains of the arterial blood.

From the lowermost two Twigs issue.

The first is called *Gastroepiplois sinistra*; this is bestowed upon the left part of the bottom of the Stomach, and the upper and left part of the *Omentum*.

The second springeth most commonly from *Ramus splenicus*, but sometime from the left Mesenterick vein; and passing along according to the length of the *Intestinum rectum*, it is inserted into the *Anus*, by many twigs. This is called *Hæmorrhoidalis interna*, as that which springeth from the *Vena cava* is called *Hæmorrhoidalis externa*.

Now followeth *Vena mesenterica*, or the right branch of *Vena porta*. Before it be divided into branches, it sendeth forth two twigs.

Vena mesenterica.

The first is called *Gastroepiplois dextra*; this is bestowed upon the right part of the bottom of the Stomach, and the upper Membrane of the Caul.

The second is called *Intestinalis*, or *Duodena*: It is inserted into the middle of the *Duodenum*, and the beginning of the *Jejunum*, and passeth according to the length of them: whence some capillary twigs go to the *Pancreas* and the upper part of the *Omentum*.

After these twigs are past from it, it enters by one trunk into the Mesentery, where presently it is divided into two branches, to wit *Mesenterica dextra*, & *sinistra*. *Mesenterica dextra*, placed in the right side, is double, and sendeth a number of branches to the *Jejunum*, *Cacum*, and the right part of the *Colon*, which is next to the right Kidney and to the Liver.

It hath fourteen remarkable though nameless branches; but innumerable small twigs. One thing is to be noted, that the greater branches are supported by the greater Glandules, and the smaller by the smaller Glandules, though they enter not into them, for the Glands wait on the *Vena lactea*.

Mesenterica sinistra passeth through the middle of the *Mesenterium*, to that part of *Colon* which passeth from the left part of the Stomach, and to the *Intestinum rectum*.

Use.

The use of the *Porta* hath been held till of late to be for the carrying nourishment to the Intestins and other parts contained in the *Abdomen*, and also to bring back from the Guts the purer part of the Chyle to the Liver to make Bloud of, and a thicker feculent part of it to the Spleen, to be by it excocted into an acid juice, and then carried

ried to the Stomach by the *vas breve venosum* for the exciting of hunger. As for this last opinion, it appears by Ligature that the *vas breve* carries its contents from the Stomach to the *Ductus splenicus*, and it is nothing but the Blood remaining from the nutrition of the Stomach (that was brought thither by the Arteries) that is now a conveying back to the Liver and so to the Heart again in its circulation. And as for the Mesaraicks carrying nourishment to the Guts, or bringing back Chyle, those errors have been sufficiently laid open before in the Chapters of the *Vena lactea* and the Liver. And their true use is only to bring back to the Liver from the Guts that Blood which remains after their nutrition, and which was carried to them by the mesaraick Arteries.

CHAP. XIII.

Of the Vena cava dispersed within the Abdomen.

THE *Vena cava* is so called from its large *Its name.*
Cavity, being the most capacious of any Vein of the whole Body; for into it as into a River or Chanel do all the other Veins like Rivulets (excepting the *Pulmonaria*) empty themselves. Both within and without the Liver it hath but a single Coat.

Its root may very properly be said to be in the *Its rise.*
Liver; for by its Capillaries it receives the Blood that is transcolated through the *Parenchyma* of the Liver from the Capillaries of the *Porta*,

and by its ascending trunk conveys it to the Heart. Now these roots may in some regard be commodiously enough also called branches; for the roots of a Tree in the Earth, as well as its boughs in the Air are spread into many branches: only there is this difference, that roots bring juice to the trunk, but boughs carry it from the same. However we shall call them indifferently roots or branches. The capillary branches then of the *Cava* are spread through the whole substance of the Liver, and not its upper or gibbous part only, as has formerly been taught; even as we said before that the Capillaries of the *Porta* were indifferently dispers'd all over it. Betwixt these Capillaries (much less betwixt their larger branches) there are no inosculations or anastomoses, but those of the *Porta* being quite obliterated in the glandulous *Parenchyma* of the Liver, these of the *Cava* arise out of the same, and whiles they pass towards the *Cava* many of them meeting together make a twig, as many twigs in like manner concurring make a branch, which still proceeding further by the accession of new twigs and branches encreaseth its chanel, untill at length it dischargeth it self into the *Cava*. And thus do all the roots of the *Cava* in the Liver. Wherein they do not all meet together in one common trunk as those of the *Porta* do, but empty themselves apart into the *Cava* without the Liver. And still the further distance the Capillaries have their origine from the *Cava*, the larger their chanel comes to be at their arrival towards it. The smaller twigs are innumerable; the larger roots joyning immediately to the *Cava* are commonly but three, though
two

two of them are presently (towards the Liver) divided into other two, as large each as themselves, so that one may account them to be five. These emptying all the Blood exhausted out of the Liver into the *Cava*, it is presently divided into the Ascending and Descending trunk. The Ascending forthwith enters the Diaphragm and marches up the *Thorax*, where we shall leave it till we come thither, and only here speak of the Descending trunk as long as it continues in the *Abdomen*.

The Descending trunk is somewhat narrower *its descending trunk.* than the Ascending, and passing down along with the great Artery it continues undivided till the fourth *vertebra* of the Loins. But in the meantime it sends forth divers slips from its trunk. As

1. The *Vena adiposa*, for the Coat and fat of the Kidneys; that on the left side goes out first.

2. The *Emulgents*, descending to the Kidneys by a short and oblique passage; these bring back that blood to the *Cava* which the emulgent Arteries carried to the Kidneys with the *Serum*.

3. The *Spermaticks* called *Vasa preparantia*. The right springeth from the trunk of *Vena cava* a little below the Emulgent; but the left from the left Emulgent it self. Of these more in the 20th Chapter.

4. The *Lumbares*, sometimes two, sometimes three, carried to be tween four *vertebra* of the Loins.

All these Veins being sent forth of the trunk, by this time it is come to the fourth *vertebra* of the Loins, where it goes to behind the *Arteria magna*, above or before which it had thus far de-

ascended, and is divided into two equal branches, called *Iliaci*, because they pass over the *Os ileon*, &c. as they go down to the Thighs.

Just about the division there spring two Veins called, *Muscula superior*, for the *Peritoneum* and Muscles of the Loins and *Abdomen*; and *Sacra*, which is sometimes single, sometimes double, for the marrow of *Os sacrum*.

Afterwards the Iliacal branches are again divided each into two other, the exterior that is greater, and the interior that is less.

From the interior arise two Veins: *Muscula media*, for the Muscles of the Hip and Buttocks; and *Hypogastrica*, which is a notable one, sometimes double, for most parts of the *Hypogastrium*, as the Muscles of the streight Gut, which are the external Hemorrhoidals; for the Bladder and its neck, the Yard, and the lower side of the Womb and its neck, which last are the Veins by which the Menstrues were believed to pass, before the circulation of the Bloud was found out; for since, 'tis known that they pass by the Hypogastrick arteries, and what Bloud is not sent forth at those times, or at other times is not spent on the nutrition of the parts, returns by these Veins to the *Cava*, and by it to the Heart.

From the exterior, three: two before it goes out of the *Peritoneum*, and one after.

1. *Epigastrica*, for the *Peritoneum* and the Muscles of the *Abdomen*; the most noted branch of it ascends under the *Musculi recti* towards the *Vene mammae*, with which they have been thought to inosculate about the Navel.

2. *Pudenda*, for the Genitals in Men and Women; this goes transversely to the middle of *Os pubis*.

3. *Mus-*

3. *Muscula inferior*, for the Buttocks.

And now the descending branches of the *Cava* are past out of the *Abdomen* into the Thigh, and begin to be called crural; and of them we shall discourse when we come to the Limbs, in Book 4.

cap. 4.

Now the use of this Descending trunk of the *Vena cava* is not to carry any thing to any part from the Liver; but wheresoever its lesser twigs end into Capillaries, from thence is Blood received (being brought thither by the respective Arteries) and conveyed into the greater branches and by them into the trunk of the *Cava*, by which it ascends to the right ventricle of the Heart, there to be anew inspirited, and from thence to be sent forth again by the Arteries, as shall be further explained when we come to the Heart.

For though the Descending trunk of the *Aorta* or great Artery pass down the *Abdomen* along with that of the *Cava*, and so is contained therein as well as it; yet because the Arteries have all of them their origine from the Heart, we will forbear to speak of them till we come to the Anatomy of it, in the next Book.

CHAP. XIV.

Of the Gall-bladder and Porus bilarius.

FOR the receiving and evacuating of Bile there are two vessels or passages framed in the right and hollow side of the Liver, namely the Gall-bladder, and *Porus bilarius*. By this latter there flows a thicker but milder, by the former a thinner, more acrimonious and fermentative Choler into the Intestins.

*Its name,
and description.*

The Gall-bladder, called in Greek *κύστις χοληδόχου*, in Latine *Vesica biliaria*, or *Folliculus felleus*, is a hollow Bag placed in the hollow side of the Liver, and in figure representeth a Pear.

Its bigness.

It is about two inches in length, and one in breadth.

Its connection.

By its upper part it is tied to the Liver, which doth afford it a hollownes to receive it; but the lower part which hangeth without the Liver, resteth upon the right side of the Stomach, and the *Colon*, and doth often dye them both yellow.

Its membranes.

It hath two Membranes, the one common, which is thin and exteriour, without *Fibres*. This springing from the membrane of the Liver, only covereth that part which hangeth without the Liver. The other Membrane is proper.

The fibres of the proper membrane.

This is thick and strong, and hath three sorts of *Fibres*; the outermost are transverse, the middlemost oblique, and the innermost streight.

Within, it hath a mucous substance or crust, engendred of the Excrements of the third concoction

coction of its Membrane, to withstand the acrimony of the Choler.

It hath two parts, the Neck and the Bottom. *The parts of it.*

The Neck is harder than the Bottom, and higher in situation.

It from the bottom by degrees growing narrower and narrower, at last endeth in the *Ductus communis*, or the common passage of the Choler, which is inserted into the beginning of the *Jejunum*, or the end of the *Duodenum*.

This elongation of the neck of the *Vesica fellea*, is called *Meatus cysticus*, because it springeth from the *Cystis*.

The Choler is conveyed into the *Vesica* by many very small roots, dispersed in the Liver between the branches of the *Porta* and *Cava*; they are so very small that they are scarcely discernible, but when they meet together, they make one pretty notable Trunk which is inserted into the *Cystis* near its Neck, with a Valve before its Mouth to hinder the regurgitation of the Choler. (For in the Jaundice the Choler does not return out of the Gall-bladder into the Bloud again, but either for want of a convenient ferment it is not separated from the Bloud, or when the neck of the *Vesica* is stoppt that none can pass out of it into the Guts, then the Gall-bladder is presently so fill'd that it cannot receive any more; and so the Choler being forc'd to stagnate in its roots, is received in by the branches of the *Cava*, and thereby contaminates the whole mass of Bloud.) But though it be evident that the Choler is brought into the *Vesica* by this Pipe, yet if one open the Bladder to look for its Mouth in the Cavity, one shall hardly find where it is; which is no wonder, seeing

seeing it is so difficult to find the insertions of the Ureters into the urinary Bladder, which are vastly larger than this. But Dr. Glisson says, that near its neck in the inside, there is a little spongy protuberance, into which this Trunk is pretty plainly inserted; and this protuberance is the same that we called before a Valve.

Its valves.

It has been taught by several Anatomists, that its Neck or *Meatus* has sometimes two, sometimes three Valves to hinder the recourse of the Choler: but *Diemerbroeck* professes he could never find any, but only that the egress of the *Vesica* was very strait, and its Neck wrinkled. Dr. *Glisson* declares also that he could never discover any in it, but on the contrary, he has often with a slight compression of his fingers found, that the Choler will fluctuate to and again, out of the *Cystis* into the *Meatus*, and on the contrary, as also out of the *Meatus* into the *Ductus communis* and back again; so that he cannot believe there is any thing of a Valve in the whole passage. But one thing which he thinks has impos'd upon Anatomists, is a certain fibrous Ring (or *Sphincter* as it were) which is seated just at the end of the Bladder and beginning of its Neck, which makes the passage betwixt them exceeding strait; but this cannot be a Valve, because as he observes the Choler will go either way through it.

Its vessels.

The *Vesica fellea* hath two Veins called *Cystica gemella*, which spring from the *Porta*.

It hath sprigs of Arteries proceeding from the right branch of the *Coliaca*. And it hath a small thread-like sprig of a Nerve from the Mesenterical branch of the Intercoastal.

Many

Many times stones are found in it, which being lighter and more spongy than those of the Bladder will swim above water. Of the stones in it.

The other passage which carrieth the thicker sort of Choler, is called *Porus biliaris*, or *Meatus hepaticus*, because it passeth directly from the Liver to the *Ductus communis*. Porus biliaris.

Within the Liver its Trunk and Branches are invested with a double coat; its proper one, which it retains without the Liver also; and another that is common to it with the *Porta* called *Capsula communis*, which it has from the membrane of the Liver. In this common coat this *Porus* and the *Porta* are so closely enwrapped that you would take them but for one Vessel, till you either hold it up to the light, (which will discover Vessels of two colours in it) or very dextrously rip up the *Capsula*, and so lay them open. Its roots within the Liver are equally divided with those of the *Porta* every where, saving that little space where the roots of the *Vesica* are spread, in the sinous and right side of the Liver. So that having spoken above of the divisions of the roots of the *Porta*, I shall refer the Reader thither for these of the *Porus*. I shall only observe that they are far larger and more numerous than those of the *Vesica*, drawing Choler from all the parts of the Liver (saving whither the roots of the Bladder reach) and that more thick and viscous, yet less acrimonious.

This *Porus* seems to be a more necessary part than the *Vesica*; for many Creatures, as Harts, Fallow-deer, the Sea-calf, &c. and those which have a whole Hoof, have no Gall-bladder, but there is none that is destitute of this.

Without

Without the Liver it is as wide again as the *Meatus cysticus*, with which it is joyned at two inches distance from the Liver, and both make the *Ductus communis choledochus*. It has no Valve in its whole progress; only the *Ductus communis*, where it enters the Intestin, having pierced the outer coat, passes betwixt that and the middlemost about the twelfth part of an inch, and then piercing that also marches down further betwixt it and the innermost coat about half an inch, and at last opens with a round mouth into the Intestin. So that this oblique insertion (as that of the Ureter into the urinary Bladder) serves instead of a Valve to hinder any thing from regurgitating out of the Gut into this Duct, especially the inmost Tunicle of the Intestin hanging so flabby before its mouth, that when any thing would enter in, it claps close upon it and stops it.

As to any anastomoses of the roots of either of these Biliary vessels with those of the *Vena porta*, such indeed have been much talkt of, but without truth, for their extream Twigs or Capillaries terminate in the *Parenchyma* of the Liver, out of whose grape-stone-like Glandules they imbibe the Choler there separated from the Blood; even as was said before of the Capillaries of the *Cava*, that they received the Blood it self imported by the *Porta*, in like manner, without any inosculation.

Their use. The use of both these Vessels may sufficiently be learned by what has already been said of them. As also may the use of the Bile it self from what we quoted above out of *Diemerbroeck*, when we were treating of the action of the Liver, chap. 12. We will only further note two things.

First,

First, that sometimes the *Ductus communis* is very irregularly inserted. For in some it is knit to the bottom of the Stomach, and then the party vomiteth Choler, and is termed *πλεῖστον ἀνω*; and sometimes it is inserted into the lower end of the *Jejunum*, and then bilious dejections follow: and such a one is termed *πλεῖστον κάτω*.

A second thing is concerning the colour of the Bile; that though for the most part, (in a healthfull state) it be yellow, yet preternaturally and in a morbus state it is often of several other colours, as pale-coloured, eruginous, porraceous, vitelline, reddish and blackish. And when it thus degenerates and corrupts, it is the cause of most violent and acute Diseases; as the *Cholera morbus*, Dysentery, Colick, &c.

CHAP. XV.

Of the Pancreas.

THE *Pancreas* (as much as to say *All-flesh*) Its substance. or the Sweet-bread, except its Membranes and Vessels, is wholly Glandulous. It seems to be compacted out of many globules or knots included in a common Membrane, and joyn'd together by the Membranes and Vessels. Every Globule by it self is somewhat hard; but all together (because of their loose connexion) seem softish. It is of a palish colour, very little tinctured with red. Its Membrane it has from the *Peritonaeum*.

It

Situation.

It is seated under the bottom and hind-part of the Stomach, and reaches from the Cavity of the Liver (namely from that part where the *Porta* enters it) to the Spleen, cross the *Abdomen*. It is knit also to the *Duodenum*, (sometimes to the) *Porus biliaris*, the *Rami splenici*, the Caul, the upper part of the Mesentery, and upper *Nervous plexus* of the Mesentery. It is not joyned to the Spleen.

Figure.

Its figure is long and flat, broader and thicker about the *Duodenum*, but towards the Spleen thinner and straiter.

Bigness.

It is lesser than most of the Bowels, but by much the greatest Gland in the Body, commonly about five fingers breadth long; where it is broadest, it is about two fingers breadth; and about one fingers breadth thick.

Vessels.

Its Vessels are of five kinds. *Veins* it has from the splenick branch; *Arteries* from the left branch of the *Celiaca*, sometimes from the splenick; *Nerves* from the Intercostal pair, especially from the upper plexus of the *Abdomen*; it has also many *Vasa lymphatica*, which, as the rest, pass to the *Receptaculum chyli*. But besides these Vessels which are common to it with other parts, it has a proper membranous Duct of its own, which was first found out by *Wirsungus* at *Padua* eight or nine and thirty years agoe. This Vessel commonly has but one Trunk, whose orifice opens into the lower end of the *Duodenum* or beginning of the *Jejunum*, and sometimes is joyned to the *Ductus biliaris* with which it makes but one mouth into the Intestin. Within the *Pancreas* (according to *Dr. Wharton*) it is divided into two Branches, which send forth abundance of
little

little Twigs into all the *Globuli* above spoken of, by whose means they receive the humours from all over the *Pancreas*, and by their Trunk transmit them to the Guts. This pancreatick humour tho' is never found in this Duct, because it so quickly flows out into the *Duodenum* by a steep way; even just as Urine, passing out of the Réins by the Ureters to the Bladder, is never found in them because of its rapid transit.

Very many have been the differences of opinions concerning the use of this Glandule. *Some* have thought it to be only of use to sustain the divisions of the Vessels, and to serve the Stomach for a Cushion; others that it ministers a ferment to the Stomach; others that it receives the Chyle, and brings it to greater perfection; and others that it serves as a Gall-bladder to the Spleen, or sometimes serves in its stead. Which opinions being all very unlikely, I shall not spend time to examine them. There are two other opinions, for the former whereof let the credit of the learned Author (*viz.* Dr. *Wharton*) recommend it as it can, but to me it seems improbable, and it is this, That it receives the excrements or superfluities of the superiour *plexus* of the Nerves of the sixth pair (Dr. *Willis's* *Inter-costal*) being united with some branches from the spinal marrow, and by its proper Vessel or Duct discharges them into the Intestins. In answer unto which I shall only say this, That I cannot tell how thick Excrements should be convey'd by the Nerves that carry such pure animal spirits, and have no visible Cavity; nor secondly how these Nerves in particular should *elective* (as he speak) send the Excrements hither, and all the rest

rest be discharged from any such Office. The
 last opinion, and to me the most probable, is
 defended by famous Physicians and Anatomists,
 as *Franc. Sylvius*, *Bern. Swalve*, *Regn. de Graef*
 and *Isbrand de Diemerbroeck*, from which last I shall
 transcribe it. "I have found, saith he, in the
 "dissections of Brutes both alive, and newly
 "strangled, a certain liquor sublimpid and as it
 "were salivous, (something austere and lightly
 "subacid, and having sometimes something of
 "saltiness mixed) to flow out of the *Ductus*
 "*pancreaticus* into the *Duodenum*, sometimes in a
 "pretty quantity. Whence I judged — that
 "there is excocted in the *Pancreas* a peculiar hu-
 "mour from the serous and saltish part of the ar-
 "terial blood brought into it, having some few
 "animal spirits convey'd thither by small Nerves
 "mixed with it, and that this liquor flowing into
 "the *Duodenum*, and there presently mixed with
 "the Bile, and the meat concocted in the Sto-
 "mach gliding by the *Pylorus* into the Guts, does
 "cause a peculiar effervescency in those aliments,
 "whereby the profitable chylous particles are
 "separated from the unprofitable, are attenua-
 "ted, and being brought to greater fusion
 "(This operation of it, says he, is shewn by the
 "diversity of the substance of the aliments, con-
 "cocted in the Stomach and still there contained,
 "from that of those that have already flow'd into
 "the Intestins: for the former are viscid and
 "thick, and have the various colours of the food
 "taken; but the latter on the contrary are more
 "fluid, less viscid, and more white) are withall
 "made apt to be impelled by the peristaltick
 "motion of the Guts, through their inner mu-
 "cous

"cous coat into the Lacteal vessels, the other
 "thicker by little and little passing down to the
 "thick Guts, to be there kept till the time of
 "excretion. Now this effervescency is caused
 "through the volatile salt and sulphureous oyl
 "of the Bile meeting with the acidity of the
 "pancreatick juice; as in Chymistry we observe
 "the like effervescencies to be caused by the con-
 "course of such things.] Thus he. So that he
 will not have this juice to be any thing excremen-
 titious, nor to be so very little in quantity as
 some have affirmed; to demonstrate which he
 cites the experiment of *de Graef*, who in live-
 dissections could gather sometimes an ounce of it
 in seven or eight hours time, which he has tasted,
 and found it of the tast before-mentioned, viz.
 something austere, subacid and saltish. *Vide ejus*
Anatomen corporis humani, p. 73, &c. where you
 may see what Diseases it is the cause of when
 distempered.

CHAP. XVI.

Of the Spleen.

THE Spleen or Milt in English, in Greek is
 called σπλήν, and from thence *Splen* in La-
 tin, and *Lien*.

The substance of it is flaggy, loose and spon-
 geous; commonly held to be a concrete san-
 guineous body, serving to sustain the vessels that
 pass through it: but *Malpighius* with his Micro-
 scope

scope has discover'd it to be a *Congeries* of Membranes form'd and distinguish'd into cells like Honey-combs. And in these cells there are very many Glands. He describes them thus (*lib. de Liene cap. 5.*) "In the Spleen, says he, there may be observed numerous bunches of Glands, or if you will, of Bladders or little Bags disperfed all over it, which do exactly refemble a bunch of Grapes. These little Glands have an oval figure, and are about as big as those of the Kidneys : I never faw them of other colour than white; and though the Bloud-vessels of the Spleen be fill'd with ink, and play about them, yet they always keep the same colour. Their substance is membranous as it were, but soft and easily crumbled; their Cavity is so small that it cannot be seen, but it may be gueffed, in that when they are cut they seem to fall into themselves. They are almost innumerable, and are placed wonderfully in the aforesaid cells of the whole Spleen, where vulgarly its *Parenchyma* is said to be; and they hang upon fibres arising from their case, and consequently on the utmost ends of the Veins and Arteries, yea the ends of the Arteries twist about them like the Tendrils of Vines, or clinging Ivy.—— Each bunch consists of seven or eight.] Thus he. It has abundance of nervous Fibres.

Number.

It is commonly but one in Men, though some have found two, yea *Fallopian* three. In Dogs there are sometimes two or three, unequal in bigness, out of each of which there passes a vessel into the *Ramus splenicus*.

Membrane.

It is covered with a Membrane borrowed from the *Peritonaeum*, which is thicker than that of the Liver.

Liver. First, because the Spleen hath a looser substance. Secondly, because it hath more Arteries, which require a strong Membrane to sustain their beatings. *Diemerbroeck* says, it has two Membranes; one from the *Peritoneum* which is outer and common; the other inner and proper, arising from the outer Membrane of the vessels entring the Spleen, interwoven with a wonderfull texture of Fibres; and that betwixt these two the *Vasa lymphatica*, of which afterwards.

In Infants new born it is of a red colour; in *Colour*. those of a ripe age it is somewhat blackish; and in old Men it is of a leaden or livid colour. Being boiled it looks like the dregs of Claret.

In Man it is bigger, thicker and heavier than in *Bigness*. Beasts; for it is six inches in length, three in breadth, and one in thickness. Sometimes it is much larger, but the bigger the worse. *Spigelius* has observed that it is larger in those that live in fenny places, than in those that live in dry; and in those that have large Veins, than in them that have small.

In figure it is somewhat long, like an Oxe's *Figure*. Tongue. Towards the Stomach on its inner side it is somewhat hollow; on its outer, gibbous, having sometimes some impression upon it from the Ribs. It is smooth and equal on either side, save where in its hollow side it has a streight line or seam (*ραιν*) at which place the splenick Vessels enter into it.

It is seated in the left *Hypochondrium* opposite *Situation*. to the Liver: (so *Hippocrat.* 6. *Epidem.* calleth it the left Liver; and *Aristot.* 3. *de histor. animal.* 7. the bastard Liver) betwixt the Stomach and that

end of the Ribs next the Back ; in some higher , in others lower : but naturally it descends not below the lowest Rib. Yet sometimes its Ligaments are so relaxed, that it reaches down lower, yea sometimes quite break, so that it slips down into the *Hypogastrium* : so *Riolanus* tells the story of a Woman that was troubled with a Tumour there, which was taken by her Physicians for a Mole, but dying of it, and being opened, it was found to be occasioned by the Spleen fallen out of its place and lying upon the Womb. And as it very much endangers life when it falls out of its place, so can it not with safety be quite cut out of the Body, whatever some have boasted of. But none but obscure Men (of no credit) have bragg'd of such feats ; and how can one imagine that a part so difficult to come at, and that has such large vessels inserted into it, (not to mention its use) could with safety be taken out of the Body ? Wounds in it are commonly mortal ; inflammation, or but obstructions in it do grievously afflict the Patient and sometimes kill him : sure then the total ablation of it must be very fatal. This experiment hath indeed been tried upon Dogs, and some have liv'd after ; but then they have grown pensive and lazy, and not liv'd long neither.

Connexion.

It is tied to five parts ; its upper part to the Midriff, and its lower to the left Kidney by small Membranes ; by its hollow part which giveth way to the Stomach being distended, to the upper membrane of the *Omentum*, and to the Stomach by *vas breve*. In its gibbous or arched part it is tied to the Back, for thither it inclines.

It

It hath Vessels of all kinds; as 1. Veins from the *Vessels.*
Ramus splenicus of the *Vena porta*, which are dis- *1. Veins.*
 persed throughout its *Parenchyma*, and come out
 of its hollow side in three or more branches,
 which unite presently into the abovesaid *Ramus*.
 The said branches at their coming out of the
 Spleen have each one a Valve which look from the
 Spleen outwards, permitting the humours to
 flow from the Spleen to the *Ramus splenicus*, but
 hindering them from returning back. And
 though one cannot discover any anastomoses of
 the Veins with the Arteries in the substance of
 the Spleen (the Blood passing out of one into the
 other in like manner as in the Liver, namely
 through and by help of the Glands) yet there is
 one notable one of the Splenick artery with this
Ramus splenicus before it enter the Spleen. Whose
 use must be, partly to further the motion of the
 humours contained in the *Ramus* towards the Li-
 ver, partly that the superfluous plenty of Blood,
 which perhaps cannot pass quick enough through
 the narrow passages of the Spleen, may return
 back again by help of this anastomosis, through
 the *Ramus* to the Liver. There is also another
 Vein called *vas breve*, which arising out of the
 bottom of the Stomach is inserted into the *Ramus*
 just as it comes out of the Spleen or a little after.
 The error of the Ancients as to the use of this
 Vessel was detected before, chap. 12. and its true
 use declared.

It hath two Arteries, entring one at its upper, *2. Arteries.*
 the other at its lower part. These commonly
 spring from the left *Cœliack* branch, which is
 called the *Splenick artery*; but sometimes (saith
Diemerbroeck) from a certain branch arising out

of the very trunk of the *Aorta*, and proceeding by a bending Duct along the side of the *Pancreas* to the Spleen, where they are branched into a thousand Twigs. By these Arteries the Blood flows to it, where if it have not a free passage into the roots of the Veins and into the *Ramus splenicus*, it causeth a great pulsation, so high that as *Tulpius* relateth (*lib. 2. observat. 28.*) it has been heard by those that have stood 30 foot off.

3. *Nerves.* Nerves it hath from one of the mesenterical branches of the Intercostal pair, which are not all spent on its investing Membrane (as has been thought) but some enter into its substance, which yet has a very dull sense; but that proceeds not from defect of Nerves (for it has a pretty many Twigs) but from that *stupor* or numbness which that acid juice that is bred in the Spleen, must be conceived to induce upon them.

4. *Vasa Lymphatica.* Though Dr. *Wharton* in his *Adenographia*, *cap. 4.* going about to prove the Spleen to be no Gland, uses this as one argument, that there were never observed any Lympheducts to be distributed through this part; yet *Olaus Rudbeck*, *Fr. Sylvius*, *Malpighius*, *Diemerbroeck*, &c. affirm it to have many, which arising from its conglobate Glands pass through the *Omentum* very plainly into the *Receptaculum Chyli*. See them expressed in the following figure of a Calfs Spleen.

- Use.* The Ancients knowing neither the true passage of the Chyle, nor the circulation of the Blood, erred grossly as to the use of this part. They thought that it attracted a more feculent and melancholick part of the Chyle, by the *Ramus splenicus*, which having a little elaborated, it sent it out again partly by the *vas breve*, and partly

partly by the internal hemorrhoidal ; but it is certain, both that no Chyle, nor indeed Bloud passeth by the *Ramus splenicus* to the Spleen, as neither any thing from the Spleen by the above-said Vessels ; but whatever they contain comes towards the Spleen, namely into the *Ramus*, and what is in it goes to the Liver. One need add no further reason to evince the error of their opinion ; nor that of those that would make it a sanguifying Bowel. Dr. Glisson (in *lib. de Hepate, cap. 45. p. 434.*) thinks it to make an alimentary juice or at least a vehicle for it, which being first imbib'd by its nervous Fibres is from them received into the Nerves, by which it is first carried to the *Glandula renales* ; where being refin'd it is received again by the Nerves, and is carried to the Brain and Spinal marrow , and from thence by the Nerves again into all the parts of the Body. We will not here enter into a dispute about the nutritious juice of the Nerves ; but supposing it, certainly this seems an odd way of conveying either it or its Vehicle thus to and again by the same sort of Vessels ; not to say that so acid a juice as is excocted in the Spleen, one should think would be no very welcome guest to the Nerves, nor be suffer'd to march so quietly, especially passing against the current of the animal spirits that continually flow from the Brain and Spinal marrow. This opinion therefore we shall pass by as very improbable, having little else to recommend it save the credit of its learned Author. And its true use we believe to be, to make a subacid and saltish juice of the Arterial blood that flows plentifully into it, which passing by the *Ramus splenicus* to the Liver serves there to make

(and further the separation of) the Bile. Now this juice is thus elaborated : There are a great many Glands in the substance of the Spleen (which being boil'd tastes something acid.) Into these Glands is the Arterial blood poured by the capillary Arteries, wherewith are mixed some animal spirits deposited into the same Glandules by the ends of the Nerves, which bridling the sulphureous spirit of the Blood, induce on it a little acidity ; and then being driven out of the Glandules by the beating of the Arteries and the pressure of the adjacent parts, it is received by the roots of the Splenick vein, and so by the *Ramus splenicus* it flows to the *Porta* and the Liver. But before it enter into the roots of the Veins, it seems to stay a little in the abovementioned Cells, (whose substance is acid) that it may acquire some more acidity by that stay in them : as Wine standing in a Vinegar-vessel sours more and more ; and as the Bile by staying in the Gall-bladder gets a greater acrimony.

The Explication of the Figures.

Figure I. *Represents the Pancreas, from Dr. Wharton.*

AA *The Parenchyma of the Pancreas opened.*

B *The Trunk of the Ductus pancreaticus.*

CCC *Its Branches.*

D *The Ductus bilarius joyning to the pancreatick Duct.*

E *The Duodenum opened.*

F *The insertion of these Vessels.*

Figure II.

of the Body of Man

Fig. 1



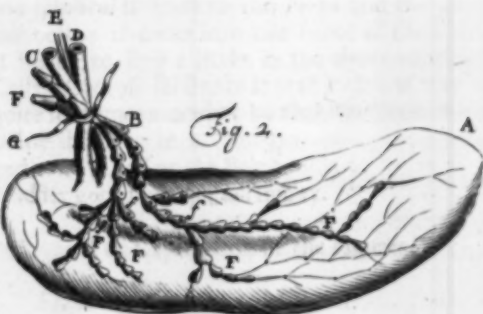


Fig. II. Represents the Lymphatick and Sanguineous Vessels of the Spleen tied.

- A The Spleen of a Calf.
- B The Sanguineous and Lymphatick vessels tied.
- C The Splenick vein.
- D The Splenick artery.
- E The Splenick nerves, whose number is uncertain.
- F The Lymphatick vessels arising out of the outer part of the Spleen.
- ffff The Valves in the said Vessels.
- G The Ligature.

Fig. III. Represents an Oxe's Spleen.

- AA The substance of the Spleen cover'd with its proper Coat.
- B A portion of the Vena portæ.
- C Its left or Splenick branch.
- D This branch opened near the Spleen that the Valve b. may appear.
- EE The Coat of the Spleen dissected and turned back, that the progress and plexus of the Vessels and Fibres may be shewn the better.
- F A portion of the Splenick artery, which running through the whole substance of the Spleen, doth dispense into it the little Twigs aaa.
- b The Valve in the Splenick branch looking outwards to the Porta.
- ccc The holes which appear in the end of Ramus splenicus leading from the substance of the Spleen.
- ddd Nerves running along the sides of the Splenick Artery.
- eee The end of the Ramus splenicus.

CHAP.

CHAP. XVII.

Of the Kidneys, and the Glandulæ renales.

Their denomination.

THE Kidney is called in Latin *Ren*, from *ren*, to flow; because the serosity of the Blood doth flow through the Kidneys to the Ureters, and through them to the Bladder. By the Greeks they are called *νεφραι*, *α νεφρι*, *mingere*, to make water.

Number.

They are in number two, both because of the great quantity of the serous excrement that is to be discharged by them; and also that one being stopped, the *serum* of the Blood might be transcolated by the other.

Places.

They are seated in the Loins behind the Stomach and Intestins, and under the Liver and Spleen, between the membranes of the *Peritoneum*; their lower end rests on the head of the Muscle *Psoas* (which is one of the movers of the Thigh) just where the Nerve enters into it, which is the cause that a big stone being in the Kidney, and pressing on the Nerve, a numbness is felt in the Thigh of the same side. In Man the right Kidney is lowest, by reason of the greatness of the Liver, and commonly bigger also than the left; yet it has not so much fat about it as the left, by reason of the vicinity of the Liver, whose heat hindereth the encrease of fat.

Figure.

In figure they resemble the *Asarum* leaf or Kidney-bean: towards the Loin or outwards they are gibbous; and also in their ends on the inside; but

but in the midst where the Vessels enter in and go out, they are hollow.

As for their connexion, by the external fat *Connexion.* Membrane they are tied to the *Diaphragma*, and the Loins; by the emulgent Vessels, to the *Vena cava*, and the *Aorta*; and by the Ureters to the Bladder. The right hath the *Intestinum caecum* join'd to it, and sometimes the Liver; the left hath the Spleen and the *Colon*.

They are in length about five inches, reaching as far as three and sometimes four *vertebra*; three fingers breadth broad, and one inch thick. In salacious or lustfull Men they are commonly larger than in others. *Signs.*

Their Membranes are two. The one is common and external, borrowed from the *Peritonaeum*; within the reduplication of which the whole Kidney is lapped; and therefore it is called *Remis fascia*. This Membrane is besmeared with copious fat; whence it is called *Tunica adiposa*; and into it entreth the *Arteria adiposa* from the *Aorta*; as also the *Vena adiposa*, which on the right side commonly ariseth from the Emulgent, seldom from the *Cava*; but on the left, always from the *Cava*. By means of this Membrane 'tis that they are both joined to the Loins and Midriff; the right, to the *Caecum* and sometimes to the Liver; the left, to the Spleen and *Colon*, as was noted before. Although they be exceeding fat, yet some part of the Kidney will remain uncovered about the middle. *Membranes.*
1. Common.

Their inner and proper Membrane is made of 2. *Proper.* the outer Coat of those Vessels that enter into them, (for they enter the Kidney with only one Coat) and this adhereth very close to them, having

having inserted into it small Nerves from the Intercostal pair, and one from that branch of it which goes also to the Stomach; whence that consent betwixt the Kidneys and it, that in the pain of the Stone in the Kidneys a vomiting is caused. But these Nerves enter the substance of the Kidneys in very few but by small slips, whence they have but a dull sense as to their *Parenchyma*.

Substance.

The substance of the Kidneys, as it appears to the bare eye, looks fibrous, compacted of the concurrence and commixture of very small Vessels joined together by a fleshy *Parenchyma* that has divers small chanel; outwardly to feel upon, it is pretty hard, but within, it is indifferent spongie; its circumference is of a dull red colour, but towards the *Pelvis* it is more pale. Thus the Kidneys appear to the sight; but *Malpighius* with his Microscope hath made a far more accurate discovery of their substance. He says (*lib. de Renibus*) "That though in grown Men their superficies seems commonly plain, yet it is unequal in Infants new born; and that in adult persons the conjunction of Globules does still appear within from the diversity of colour, which in the several Globules outwardly and towards the sides, to which they are joined, is red, but more pale on the inner side. And as in Brutes these Globules being round outwards, and extended inwards into an obtuse narrowness become quadrangular, quinquangular or sexangular and so are joined together; so also in Men there may from the diversity of colour be manifestly observed a like but more firm conjunction. — If one take off the Membrane from a fresh

“fresh and as yet soft Kidney, there may by a
“good Microscope be discovered certain round
“and short Bodies roll’d about like little worms,
“not unlike those that are found in the substance
“of the Kidneys being cut through the middle ;
“and under the outmost superficies one may ob-
“serve wonderfull branches of Vessels, with their
“Globules hanging at them, which run towards
“the *Pelvis* ; as also certain continued winding
“spaces and sinus’s running through all the outer
“superficies of the Kidneys, that become con-
“spicuous by injecting ink through the emulgent
“Arteries: and moreover, innumerable small
“pipes which look something like fibrous or pa-
“renchymatous flesh, but are indeed membranous
“and hollow ; these make up a great part of the
“substance of the Kidneys, and are the excretory
“Vessels of the Urine. Moreover he says, that
“if (after the Membrane is removed) one make
“injection into the emulgent Artery with the
“spirit of Wine tinged black, he may discern in-
“numerable very small Glandules hanging upon
“forked Arteries, which by the injection are al-
“so coloured black ; as also many others in the
“interstices of the Urinary vessels, which hang
“like Apples upon the Arteries, (now fill’d
“with the black liquor, and branched like a
“Tree.) He thinks that from these Glands into
“which the extremities of the Arteries end, the
“roots of the Veins arise, and that the Nerves
“reach to them too ; and that it is probable that
“the excretory Vessels of the Ureter are extended
“so far also, seeing this is constant in all Glands,
“that every little Globule has besides the Arte-
“ries and Veins, a proper excretory Vessel, as
“the

"the Bilary in the Liver, &c. And he has observed that those same Pipes or Urinary fibres do many of them terminate in one of the *Papilla*, (twelve into one) through which the Urine is transcolated into the *Pelvis*, for into it they jet out; and that the same siphons or urinary Vessels are produced from the circumference to these *Papilla* as to their centre.] By this curious and accurate description of their substance he has greatly dispelled that mist of ignorance that Anatomists hitherto were in as to their frame and *Parenchyma*. But to proceed.

Emul-
gents.
1. *Arteries.*

The *Emulgent artery*, springing from the descending Trunk of the *Aorta* goes into the hollow side of the Kidney, being first divided into two; but in the Kidney it is spread in divers branches through its whole substance, and ends in it in very small and invisible Capillaries. By it much blood is conveyed to the Reins (for it is a great Artery) partly to nourish them and the Urinary vessels, partly that in their Glandules a good part of the *Serum* may be separated from it, which being carried by the Urinary fibres to the *Papilla* ouzes through them into the *Pelvis*.

2. *Veins.*

The *Emulgent vein* is a little larger than the Artery. Its roots spring from the Glandules in the Kidney, which being united into one Trunk comes out where the Artery goes in, and opens into the *Cava*, into which it discharges the Blood remaining from the nourishment of the Kidney, now freed from a good quantity of *Serum* in the Glands. For that there passes nothing by this Vein to the Kidney is plain, as from the general office of Veins, which always carry from the part where their Capillaries are spread (excepting the

the *Vena porta*, which indeed has the office of an Artery) so from that notable Valve that is placed at its entrance into the *Cava*, looking towards it from the Kidney, so that the Bloud may freely pass out of the Emulgent into the *Cava*, but not back again. The Emulgent vein sometimes comes divided out of the Kidney, as the Artery goes in ; but both the branches are presently united into one, and always open by one orifice into the *Cava*.

Of the Nerves we have spoken before, discoursing of the proper Membrane of the Kidneys ; and as to Lympheducts there has no certain discovery been yet made of any in them.

Within the Kidney there is a membranous Cell or *Sinus*, called *Pelvis* or *Infundibulum* (i. e. the Basin or Tunnel) which is made of the Ureter expanded and dilated, and comes into the Cavity of the Kidney with eight or ten open and large Pipes. Into this *Pelvis* does the *Serum* issue from the Urinary siphons through the *Caruncula Papillares* or *Mammillares*, for one of these stands at the head of each of the said eight or ten Pipes, (being of an equal number with them) and are like Glandules, of a fainter colour but harder than the rest of the *Parenchyma* ; they are about as big as a Pease, flattish above, but round or bunching out on that side next the *Pelvis* ; their perforations are exceeding narrow, so that they will hardly admit the smallest hair.

The Pelvis.

The action of the Reins is to separate and evacuate the serous humour from the Bloud, which, as was said, is brought to them together with the Bloud by the Emulgent arteries ; which is done in this order. After the two branches of the
Emulgent

Their ass.
on.

Emulgent artery are enter'd the Kidneys, they are presently each of them divided into four or five, and those again into many more, till at last they end in the smallest Capillaries which terminate in the Glandules towards the outer superficies, whereinto they infuse their liquor. Into the same Glandules are inserted also the Capillary veins, and the Urinary siphons, each of which imbibe thence their proper liquor. By the Veins the Blood returns into the larger branches of the Emulgent veins, from thence into the single Trunk, and by it to the *Cava*, which conducts it to the Heart: But by the Urinary pipes does the *Serum* drill to the *Papilla* or *Caruncula* placed at the entrance into the *Pelvis*, through which it distills into it. And this *Pelvis* being the head of the Ureter, the *Serum* glides readily out of it down by the Ureter into the Bladder.

But now it is very difficult to determine, whether this separation of the *Serum* in the Kidneys be procured by any kind of effervescency or fermentation; or whether they serve meerly as a strainer, through which it is squeezed or transcolated. If it be separated only this last way, how admirable is the configuration of the Pores, that the *Serum* with all its contents should pass by them without the least drop or stain of blood, when yet often purulent matter, brought out of the *Thorax*, and thoroughly mixed with the Blood, and which is far thicker than the Blood it self, passes through them with the *Serum*, and not any thing of Blood at the same time! That such purulent matter passes by Urine, is frequently observed; but whether it be absorbed out of the Cavity of the *Thorax* by the mouths of the Veins
gaping

gaping into it, as the Ancients thought it might ; or it be bred in the *Parenchyma* of the Lungs apostemating, as is more probable, 'tis not a fit place here to inquire. As neither would it signifie much to give you the conjectures of some learned Men, that because such *Pus*, and much more because Pins, Needles, an Iron nail, &c. have passed by Urine ; that therefore there must be some more direct and patent way for part of the *Serum* to be convey'd by to the Bladder ; and therefore have imagined that some Lacteals have been inserted into the Bladder, as others have supposed other ways : for as far as could ever be discover'd by Anatomists, there is no footstep of any such passage, how plausible soever such an *Hypothesis* may seem. And therefore we shall say no further of it.

Some have thought the Kidneys to have other Actions besides the separating of the *Serum* ; as further to elaborate the Bloud, to prepare the Seed, &c. But these opinions are grown obsolete, and therefore rather to be neglected than examin'd.

Above each Kidney at about half an inch distance there stands a Gland, by some called *Glandula renalis* ; by others *Ren succenturiatus* ; by Bartholin, *Capsula atrabilaria* ; by Dr. Wharton, *Glandula ad plexum nervum sita*. Which several names they have had given them, from the several uses the Imposers have ascribed to them.

They are commonly but two, and are placed over (but towards the inside of) the Kidneys, having the fat about the Kidney coming between. The left is nearer to the Diaphragm, standing
H higher

higher than the right, but the right is nearer to the *Vena cava*.

Figure and Substance. They are seldom of the shape of the Kidneys, but are of not much an unlike substance. Their figure is often three corner'd, having the shape of a Satchel with its bottom upward. Sometimes they are oval but flattish.

Magnitude. They are bigger in Children proportionably than in Men; for in the former they are near the bigness of the Kidneys; but they do not increase as other parts do, so that in adult persons they are not above two inches long and one broad. Commonly the right is bigger than the left.

Membrane. They are covered with a thin Membrane which is knit very fast to the outer or adipose Membrane of the Kidneys.

Cavity. They have a manifest Cavity in their larger end, in which is contained a black and seculent humour, that tinges the sides of the Cavity. Into it there are a great many little holes gaping out of the substance of the Gland, according to Dr. Wharton; and it self opens into a Vein, but has a Valve placed just at the entrance, that permits the humour contained in the Cavity to flow out by the Vein, but hinders its return.

Vessels. They have Veins and Arteries commonly from the Emulgent, sometimes from the *Cava* and *Aorta*, and sometimes from the *Vasa adiposa*. Their Nerves come from the stomachick branch of the Intereostals that runs to the proper Membrane of the Kidneys and to the Spleen also. Lacteals they have none. Bartholin affirms they have Lymphaticks.

Use. There have been divers conjectures of the use of these Glands, but none generally consented to

is true. Dr. Wharton's guess is, that some humour is imbib'd from the Spleen by the Nerves that are common to the Spleen and these Glandules (being both from one branch) and is deposited in their Cavity, which being not purely excrementitious (though perhaps unprofitable to the Nerves) is restored again to the Veins. Dr. Glisson also thinks they receive something from the Spleen, which being refin'd here is imbib'd again by the Nerves, by which it ascends to the Brain or Spinal marrow, and descends again by them, being either it self a *Succus nutritivus*, or else a Vehicle for it. *Riolanus* thinks they are of no use at all in Men, but only in the *Fetus* in the Womb. *Weslingius*, *Bartholin* and many others think that they make a ferment or *Coagulum* for the use of the Kidneys to help the separation of the *Serum* from the Blood. And this indeed were a probable use if there could be found out any way whereby ought could conveniently pass from hence to the Kidneys. But the Veins that go out of them are inserted either into the Emulgent vein or the *Cava*, whose Blood is flowing from the Kidneys, so that it cannot pass this way, unless one would suppose a contrary course of humours in the same Vessel, which seems absurd. And there are no other Vessels to serve this tuff. *Diemerbroeck* conjectures that their black juice is made of the Arterial blood, and acquires a certain fermentative power necessary for the Venous blood, into which it is received by the *Cava* from the Veins that go out of these Glandules. But this, says he, is but a conjecture. And in truth all the other opinions are no more, nor very probable ones neither, so that we must

still acknowledge our ignorance of their true use.

CHAP. XVIII.

Of the Ureters.

THE Ureters, in Latin *Medus urinarii*, are called in Greek *μεδουραι*, either from *μεδω*, to piss, or *μεδω* *μεδω*, because they keep the Urine.

Their
origine.

They arise out of the inner *Sinus* of the Kidneys, whose various Pipes (nine or ten) uniting into one make the Ureter.

Number.

There is one in each side.

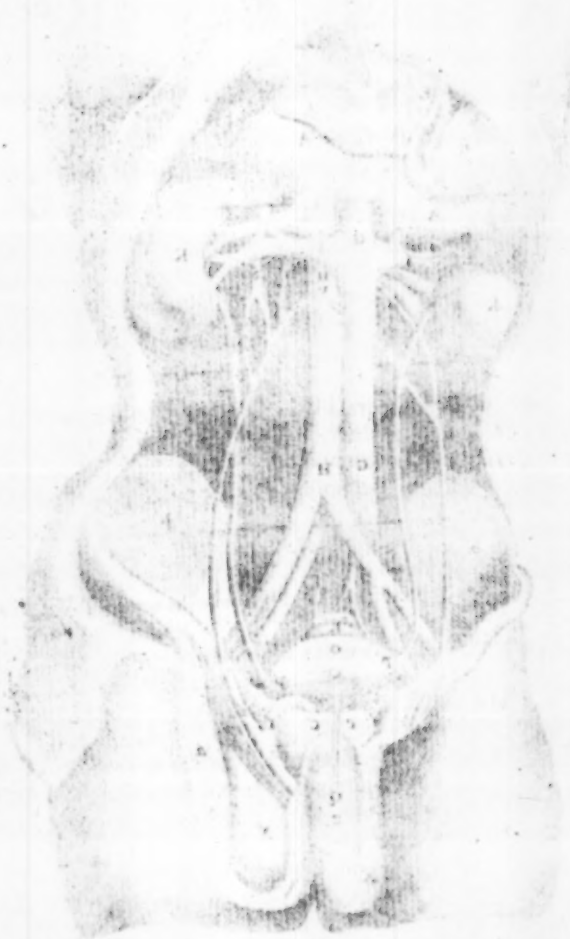
Substance.

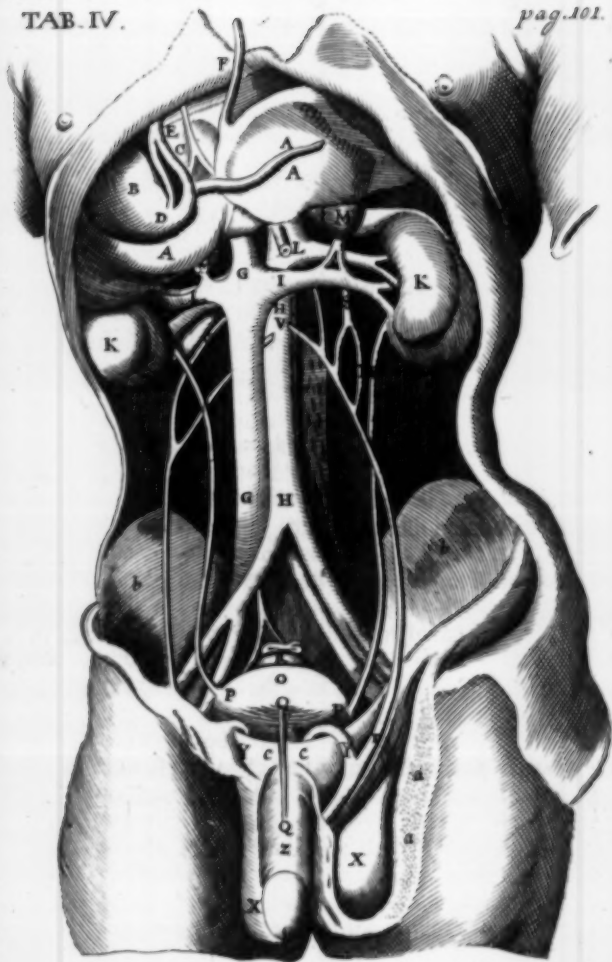
They are white Vessels, like to Veins; yet they are whiter, thicker and more nervous. They reach from the Kidneys to the Bladder, not in a direct line, but something crooked like an Italic.

Coats and
Vessels.

They have been thought to have two Coats, the one common from the *Peritonæum*; the other proper: but indeed it is but one, and that proper. It is strong, nervous, strengthened with oblique and streight Fibres, having small Veins and Arteries from the neighbouring parts. As to their Nerves Dr. Willis saith, that after the Intercostals have sent forth all the Mesenterick nerves, each Trunk descending sends forth three or four several slips that are carried into the Ureters, which makes the pain so very exquisite when some viscid matter or stone sticks in them.

As





As they go out of the Kidney they pass over the Muscles *Psoa* (which bend the Thigh) between the two Membranes of the *Peritonaeum*, and descending as abovesaid, they are inserted in the Back and lower part of the Bladder, (not far from the Sphincter) running between the two proper Coats of it, about the length of an inch, and continued with its inner substance.

This insertion is oblique to hinder the regurgitation of the Urine, when the Bladder is either compressed or distended with Urine; for here is no Valve, as some have affirmed. *Why the insertion is oblique.*

Although the Ureter doth not ordinarily exceed in compass a Barly-corn, yet when Stones do pass, it becometh sometimes as large as a small Gut.

Their use is to receive the Urine separated from the Blood in the Kidneys, and to convey it into the Bladder, thence at discretion at certain times to be emptied out of the Body. *Use.*

The Explanation of the Figure.

AAA The sinuous or hollow part of the Liver.

B The Gall-bladder.

C The Ductus bilarius turn'd upwards.

D The Vena cystica.

E The Artery distributed both into the Liver and Gall-bladder.

F The Umbilical vein turn'd upwards.

GG The descending Trunk of Vena cava.

HH The descending Trunk of the great Artery.

II The Emulgent veins.

KK The Kidneys in their natural situation.

LL The Emulgent arteries.

- MM The Renes succenturiati with the propagines
sent to them from the Emulgents.
- NN The Ureters descending from the Kidneys to
the Bladder.
- O The bottom of the Bladder.
- PP The insertion of the Ureters into its sides.
- QQ A portion of the Urachus.
- R A portion of the straight Gut cut off.
- SS The Venæ preparantes, the right whereof
springs out of the trunk of the Cava, the left out
of the Emulgent vein.
- T The Corpus pyramidale express on the left
side.
- V The rise of the Arteriz preparantes out of the
trunk of the Aorta.
- XX The Testicles, the left whereof is divested of its
common Coat.
- YY The Vasa deferentia, ascending from the Te-
stes to the Abdomen.
- Z The Yard.
- aa The Cod, that cover'd the left Testis, separated
from it.
- bb The Ossa ilia.
- cc The Ossa pubis.
- dd The Loins.

CHAP. XIX.

Of the Bladder.

THE Bladder is called in Latin *Vesica urinae*. Its name.
ria, in Greek *ὕδωρ* from its office.
 It is membranous.

It is seated in the *Hypogastrium*, betwixt the *Seat*,
 two Coats of the *Peritoneum*, in that Cavity that
 is formed of the *Os sacrum*, Hips, and *Ossa pubis*,
 and is called *Pelvis*. In Men it lies upon the *Inte-*
stinum rectum; in Women it adheres to the neck
 of the Womb, which is placed betwixt the Blad-
 der and the streight Gut: in both it is tied before
 to the *Ossa pubis*. Moreover it is knit to the Navel
 by the *Urachus*.

The Membranes of it are three.

Mem-
branes.

The first is from the *Peritoneum*; for it is con-
 tained within the reduplication of it. This in
 Man is besmeared with fat, but not in Beasts.

The second is thicker, and endued with car-
 nous Fibres, which *Aquapendens* and *Bartolin* will
 have to be a Muscle serving for the compression of
 the Bladder, to squeeze out the Urine, as the
Sphincter serveth for constriction, to retain it.

The third and innermost is white and bright,
 of exquisite sense, as they can witness who are
 troubled with the Stone.

Fibres.

It hath all sorts of Fibres.

Within it is covered with a slippery mucous
 Crust, which is an Excrement of the third con-
 coction of the Bladder. This doth defend it
 from the acrimony of the Urine.

It

*Perforati-
on.*

It is perforated in three parts, to wit, in the Sides, where the Ureters are inserted, to let in the Urine; and before, to let it out.

Parts.

The Bladder hath two parts, to wit, the bottom and the neck.

The *bottom* comprehends the upper and larger part of the Bladder, to which the *Urachus* being tied reaches to the Navel, which together with the bordering Umbilical arteries becomes a strong Ligament in the adult; hindering the Bladder to press upon its neck. Of the *Urachus* see chap. 33.

The *neck* is lower than the bottom, and straiter. In Men it is longer and narrower, and being carried to the rise of the Yard opens into the *Urethra*; in Women it is shorter and wider, and is implanted into the upper side of the neck of the Womb: In both it is carnous, woven of very many Fibres, especially transverse or orbicular, which lie hid within the streight Fibres that surround the whole body of the Bladder, and these make the Sphincter muscle, which constricts the neck of the Bladder so, as no Urine can pass out against ones will, unless when it is affected with the Palsie or other malady, by which there sometimes happens an involuntary pissing. As the neck opens into the *Urethra*, there is hung before it a little Membrane like a Valve, which hinders the flowing of the Seed into the Bladder, when it is emitted into the *Urethra*. This Membrane is broken by putting up a Catheter into the Bladder, and sometimes corroded by a *Gonorrhœa*.

Figure.

The Bladder is oblong, globous and round, in shape like unto a Pear.

Its

Its Cavity is but one ordinarily; yet sometimes it has a membranous partition, that divides it into two; which yet has a hole in it for the communication of each Cavity. Such a partition was observed in the Bladder of the Great Casaubon.

It hath *Arteries* and *Veins* from the *Hypogastri-Vessels*, which are inserted into the sides of its Neck, where they are immediately branched into two, whereof one is spent upon the neck, and the other on the bottom. *Nerves* it hath (according to Dr. Willis) from the lowest *Plexus* of the *Intercostals* in the *Abdomen*, and from the *Marrow of Os sacrum*. For the said *Plexus* sending two *Nerves* into the *Pelvis*, they have each of them a *Vertebral nerve* joined to them, and so make two new *Plexus*, from one of which there passes a *Nerve* that, being divided into many branches, is on each side distributed into the *Bladder* and its *Sphincter*.

The use of the *Bladder* is to receive the *Urine* from the *Ureters* and to contain it, like a Chamber-pot, untill the time of excretion, when it is squeezed out of it partly by the help of its own carnous Membrane, and partly of the Muscles of the *Abdomen*.

Bartholin quotes some observations of *Borrichius* concerning the *Bladder*, worthy to be noted, viz. If it be boil'd in acids, it turns into a Mucilage; if in salt liquors, it is thickned; if in oleous, or in the liquor of the *Alkali salts* of *Tartar* or *Herbs* burnt to ashes, it is neither thickned nor turns into a Mucilage, but is burnt as if it were laid on burning Coals, and may almost be crumbled to powder. By which, says he, it appears,

appears, with what great danger to the Bladder Men inject into it either acid, salt, or oleous liquors, for breaking the Stone.

CHAP. XX.

Of the Vasa preparantia in Man.

Hitherto we have handled the parts appointed for nutrition, whereby the nutriments are prepared in the lower Belly for the sustentation of an individual body : Now we come to the organs of generation, whereby through procreation is conserved a perennity of Mankind, which Nature hath denied to particulars. These parts being not alike in both Sexes, we must necessarily treat of each apart, and first of those of Men.

*The parts
of the geni-
tals in
man.*

In Man some of these parts afford matter for the Seed, to wit, the *Arteria spermatica*; others bring back again the Blood that is superfluous to the making of the Seed and to the nourishment of the Testicles, and these are the *Vena spermatica*; and both the Arteries and Veins were formerly called *Vasa preparantia*: some make the Seed, as the testes: some carry the Seed back again, as those which are called *Vasa deferentia*: some contain the Seed, and an oleaginous matter, as the *Vesicula seminales* the first, and the *Prostates* the latter: some discharge the Seed into the Matrix; this is done by the *Penis*.

*Vasa prę-
parantia.*

Vasa preparantia, which are said to prepare matter for the Seed, are of two sorts, Arteries, and Veins.

The

The Arteries are two, and spring from the Trunk of the *Aorta*, commonly two fingers breadth under the Emulgents, not just from its side but out of its fore-part, the right whereof climbing over the trunk of the *Vena cava*, runs obliquely to the Vein of the same side; as also the left, marches to the Vein of that side. Arteries.

The Veins are also two. The right arises usually from the trunk of *Vena cava*, a little below the Emulgent; the left from the Emulgent it self, for otherwise it must have gone over the *Aorta*, whereby it might have been in danger of breaking; or rather by the continual pulse of the Artery the recourse of the Venal blood might have been retarded. Now both these Veins and Arteries a little after their rise meet, and are invested both in one Membrane made of the *Peritoneum*, and then run streight through the region of the Loins above the Muscles *Psoa* on each side, and above the Ureters, as they go bestowing little slips here and there upon the *Peritoneum*, between whose duplicature they descend, and so arrive at its processes. The Veins divide very often into many branches, and by and by inosculate and unite again; but the Arteries go along by one Pipe only, on each side, untill within three or four fingers breadth of the Stones, where each is divided into two branches, the less whereof runs under the *Epididymis*, the larger to the Testicle. And as I said they descended betwixt the Membranes of the *Peritoneum*, so they pass into the *Scrotum* between them, not perforating them in the processes, as in Dogs and other Creatures, wherein the processes of the *Peritoneum* are hollow like a Quill; but in Man the inner Membrane Veins.

Membrane of the *Peritoneum* shuts the hole lest the Intestins fall by it into the Cod; of which there is great danger in him (and we see it often happen) because of his going upright. But to return to the *Vasa preparantia*. It has been generally taught that there are divers inosculations of the Arteries with the Veins in their passage, whereby the Venal and Arterial blood are mixed; but this opinion is now exploded, for that, granting the circulation of the Blood, it is impossible. For the Blood in the Arteries descends towards the Testicles, and that in the Veins ascends from them, so that if these two Vessels should open one into the other, the Blood in one of them must needs be driven back, or else, stagnating, distend and break the Vessels. But the truth is, the Blood both for the nourishment of the Testicles and the making of Seed flows down by the Arteries only, and that in an even undivided course, without any of those windings and twirlings like the Tendrels of Vines talkt so much of, (as the curious *de Graef* by his own frequent inspection testifies :) But the Veins bring back from the Testicles what of the Blood remains from their nourishment and making of Seed, and these indeed come out of the Testicles by almost innumerable roots by which they imbibe the said Blood, and are most admirably interwoven and inosculated one with another till about four or five fingers breadth above the Testicle, which space is called *Corpus pyramidale*, *Plexus pampiniformis*, or *Varicosus*; but these Veins are so far from preparing the Seed, as that they only bring back what was superfluous from the making of it. And indeed the *Arteries* in Men do no more merit the

the name of *Preparantes* in respect to the Seed, than the *Gullet* in respect of the Chyle, or the *Ductus thoracicus chyliferus* in regard to the Bloud. But however, we continue the old names, declaring only against the reason of them. And we will only note two things more. First, that these Spermatick veins have from their rise to their end several Valves which open upwards, and so suffer the Bloud to ascend towards the *Cava*, but not to slide back again. Secondly, that though the Spermatick Arteries go such a direct course in Men, as has been said; yet in Brutes they are more complicated and twisted with the Veins, but without any anastomoses of one into the other.

There are Nerves and Lympheducts that pass into the Testicles together with these *Vasa preparantia*; of which in the next Chapter.

CHAP. XXI.

Of the Stones, or Testicles, and the Epididymidæ.

THE Stones in Latin are called *Testes*, either *Their name* because they testifie one to be a man, or because amongst the Romans none was admitted to bear witness but he that had them. In Greek they are called *ἑσδύοι*, *Twins*, because according to nature they are always two.

They have a peculiar substance, (such as is *Substance*, not in all the Body besides) whitish and soft, made

made up of innumerable little ropes of Seed-carrying vessels : there is no Cavity in them ; but those said Vessels are continued to one another, and carry the Seed in their undiscernible hollow-ness. The way to make these Vessels visible, *de Graef* has taught us : viz. Tye fast the *Vas deferens* in a Live-dog or other Brute, and then these internal Ropes of Vessels, otherways inconspicuous, will presently be so filled and distended with seminal matter, as that they may be easily discerned.

Number,
Situation,
Figure and
magnitude.

They are in number two, hanging without the *Abdomen*, at the root of the Yard, in the Cod. Their figure is oval, only a little flattish. Their bigness differs very much in several persons ; as big as a Dove's Egg is reckon'd a mean size. *Hippocrates* held the right to be bigger and hotter than the left, and therefore called it *αἰσχρογόνος*, the Male-getter, as the left *ἐμμενογόνος* the Female-begetter. But these are fancies that are obsolete, and indeed seem ridiculous, seeing there is no such difference of their bigness, and that their Vessels are common.

Vessels.

They have *Arteries* and *Veins* (as was said before) from those called *Vasa preparantia*. Which some have thought to reach only to the inmost Coat called *Tunica albuginea*, because they are not conspicuous in the inner substance of the Testicles. But that comes to pass by reason that the Arterial blood presently loses its colour, and by the seminifick faculty of the Stones is turned into Seed, which being whitish, of the same colour with the Vessels, makes them undiscernible. Yet in those Men that have died of languishing Diseases, and whose *Testes* have their faculty im-
paired,

paired, *Diemerbroeck* affirms that he has oft discover'd Sanguiferous vessels in the inmost parts of the Stones, and has shew'd them to many in the publick Anatomical Theatre. As for *Nerves*, *Dr. Willis* says he could never observe more to go to them than one from a Vertebral pair, and that that too was most of it spent upon the Muscle *Cremaster*. *Diemerbroeck* agrees to one Nerve, but thinks it proceeds from the sixth pair, (which is *Dr. Willis's* Intercostal, as distinguish'd from that commonly call'd the sixth, but his eighth.) Others will have branches from both these Nerves to go to them. Concerning the use of these Nerves there is great controversy. *Dr. Glisson*, *Wharton*, &c. will have them to convey a *Succus genitalis*, which makes the greatest part of the Seed. *Dr. Willis*, as he denies (in *Cerebri anatome*, cap. 27.) any *Succus nutritivus* to be conveyed by the Nerves to other parts, so that any *Succus genitalis* is brought by them hither, but only animal spirit. And whereas to strengthen the former opinion 'tis usually objected, That the Seed must needs consist of a nervous juice and plenty of spirits brought from the Brain, because of the great debility and enervation that is induced upon the Brain and Nerves by the too great expense of it: he thus answers, That this comes to pass, because after great profusions of Seed, for the restauration of the same humour (whereof Nature is more solicitous than for the benefit of the individual) a greater tribute of spirituous liquor is required from the Blood to be bestowed on the Testicles: wherefore the Brain being defrauded of a due income and afflux of the said spirituous liquor, languishes; and so the animal spirits

spirits failing in the fountain, the whole Nèrvous system becomes depauperated and flaggy. Where-to may be added, that also the animal spirits themselves that actuate the *Prostates*, being derived from the Spinal marrow, are much wasted by venereal acts; so that for this reason besides, the Loins are enervated.] In this answer *Bartholin* acquiesces. And *de Graef*, *Diemerbroeck*, &c. confess indeed that the spirituous Arterial blood is impregnated with Animal spirits from the Nerves, but affirm that the matter out of which the Seed is elaborated is only the said Blood; and to these we subscribe. *Lympheducts* they have also arising from betwixt their Coats, and ascending upwards into the *Abdomen* with the *Vasa deferentia*. These have many Valves looking upwards, which hinder any thing from descending by them to the *Testes*, but permit the *Lympha* to ascend, which they convey into the Chyliferous vessels.

Coats.

They have two sorts of *Coats*, proper and common.

The *common* invest both the *Testes*, and are two. The outermost consists of the Scarf-skin and True skin (here thinner than in other places.) This is called *Scrotum*, hanging out of the *Abdomen* like a Purse. It is soft and wrinkled, and without fat. This on the outside has a Suture or Seam that runs according to the length of the Cod, and divides it into the right and left side. The other common Coat is the *Membrana carnosa*, here also thinner than other-where; this is called *Sicis*, growing to the proper Coat next under it (called *Vaginalis*) by many membranous Fibres.

The

The proper Coats are also two, and these enclose each Stone apart. The outer is called *Elythroides*, or *Vaginalis*; because it contains the Stone as a sheath. It is a thick and strong Membrane, having many Veins. In the outside it is uneven, by reason of the Fibres by which it is tied to the *Dartos*; but in the inner side it is smooth. This is nothing else but the production of the *Peritoneum*, even as the *Scrotum* is of the Skin of the *Abdomen*. Into this Coat is inserted the Muscle *Cremaster*, of which presently. The inmost is *ὑπὸ τοῦ νεφροῦ*, the Nervous membrane, called *Albuginea*, from its colour. It is white, thick and strong, framed of the external Tunicle of the *Vasa preparantia*. It immediately enwraps the Stone, towards which it is rough, but on the outside next the *Vaginalis* it is smooth; and between these two the water is contained in an *Hernia aquosa*.

Into the outer of the proper Membranes (as *Muscles*. was said) is inserted the Muscle *Cremaster*. These Muscles (to each Stone one) in Men have their rise from the Ligament of the *Ossa pubis*; and almost encompassing round the processes of the *Peritoneum* descend with them to the Testicles; where their carnosus Fibres run through the whole length of this same *Tunica vaginalis*, especially in its lower part, and so keep the Stones suspended; from whence they have their name (from *νεφροῦ* *suspendo*.) These pull up the Stones in the act of generation, that the Vessels being slackned, may the more readily void the Seed.

These Muscles in sickness and old age become flabby, and so the *Scrotum* relaxeth it self, and the Stones hang low.

I

Upon

Epididymidz.

Upon the Stones, as yet clad with the *Tunica albuginea*, are fixed the *Epididymida* (called also *Paraftata*) enwrapped in the same Coat with the Spermatick vessels. They adhere closer to the Testicles at their ends than in the midst. *De Graef* defines them to be *Vessels making with their various windings that Body that is fixt on the back of the Testicles*. To find out their substance he directs us thus. “ First take off the Membrane “ that encompasseth them and knits them to the “ Stones, and then there will appear many windings, which with the edge of a knife may “ without hurting the Vessels be so easily separated from one another, that they may be drawn “ out into a length like a thing folded: for they “ are only folded from one side to the other, and “ are kept in that site by the Membrane received “ from the *Tunica albuginea*, (or *Spermatick vessels*.) But when you have unravel’d half of “ them you must cut another very thin Membrane, “ and then you will see the Vessels lie just like “ these, and may be dissolved like them. And “ the whole being unravel’d, the thicker they “ are by how much further from their origine, “ which is implanted into the upper part of the “ Testicle by six or seven ramifications: which “ having run so far as where they join into one “ duct, make it as thick as a small thread; and “ this by degrees so thickens, that being increas’d “ like a cord it makes the *Vas deferens*, (of which “ in the next Chapter.)

“ So that (saith he) it is clear from hence, “ first, that the *Testes* do not differ from the *Epididymida* (or *Paraftata*) saving that those “ consist of divers ducts; but these, after their “ six

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Fig. 1.

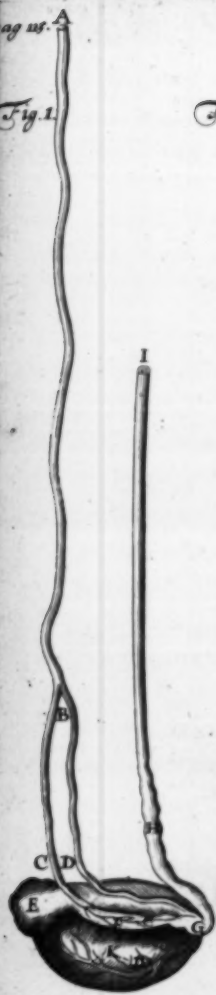
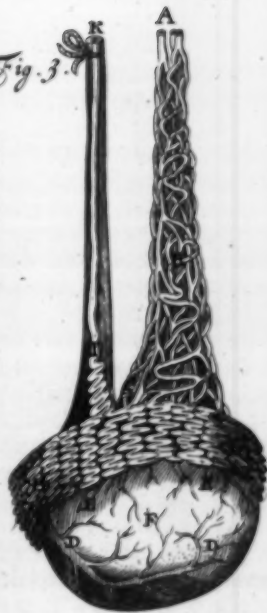


Fig. 2.



Fig. 3.



" six or seven roots that arise out of the Testicle
 " are united, (which they are in a short space)
 " but of one , only a little thicker. Secondly,
 " that the *Epididymide* differ not from the *Vasa*
 " *deferentia*, saving that those go by a serpentine
 " winding passage, and these by a streight, and
 " that those are a little softer and narrower.
 " And so (concludes he) following this *Ariad-*
 " *ne's* thread we have happily made our way out
 " of the Labyrinth of the *Testes* and *Epididymide*.

The *uses* of the Stones are two :

Use.

The first is to elaborate the Seed by the semi-
 nifical faculty resident in them. For they turn
 the Blood, which is brought by the *Arteria prapa-*
rantes, and impregnated with Animal spirit, into
 Seed, for the most part ; some is spent on their
 own nutrition ; and what remains from both is
 carried back by the Veins called *Praparantes*.

The second is, to add heat, strength and cou-
 rage to the Body, as gelding doth manifest, by
 the which all these are impaired.

The Explanation of the Table.

Figure I.

A The Artery preparing Seed, running from the
 Trunk of the Aorta to the Testicle.

B Its division into two branches.

CC The lesser branch thereof, which runs to the *E-*
pididymide.

DD The greater, which is implanted into the upper
 part of the Testicle and descends along its
 back towards its lower part, to which the

The ANATOMY

smaller end of the Epididymis is annexed ; then it goes back again along the Belly of the Testicle, where it is divided into many branches.

- E The greater end of the Epididymis knit close to the upper part of the Testicle.*
- F The middle part of the Epididymis turn'd up, that the ramifications of the Artery that run along its lower part, may be seen.*
- G The smaller end of the Epididymis sticking firmly to the lower part of the Testicle.*
- H The end of the Epididymis, or beginning of the Vas deferens.*
- I The Vas deferens cut off, before it come to behind the Bladder.*
- K The Testicle placed so as that its Vessels may best be seen.*

Figure II.

- A The Vein said to prepare Seed running from the Trunk of the Vena cava to the Testicle.*
- BB The branches of the Vena præparans tending to the Caul and Peritonæum.*
- C The first division of it into two branches, which afterwards are wonderfully subdivided and united again.*
- DDDDD The Valves of the Venæ præparantes, about which the Veins being blown up appear knotty.*
- EEEE Very many divisions and unions of the Venæ præparantes, that the Blood superfluous from the generation of Seed, being detained in one ramification, may return to the Heart by the other.*

F The

- F The upper part of the Testicle into which the ramifications of the Vena præparans are implanted.
- G The ramifications of the Venæ præparantes creeping along the sides of the Testicles through their white Coat.
- H The body of the Testicle.
- I The bigger end, K the middle, and L the smaller end of the Epididymis.
- M The Vas deferens cut off almost in the middle.

Figure III.

- A The Preparing vessels cut off.
- B The Preparing vessels as they run to the Testicles.
- C Their ramifications tending to the Epididymidæ.
- D The greatest branch of the Arteria præparans running along the Belly of the Testicle.
- EE The ramifications of the Venæ præparantes.
- F A Dog's Testicle swelled with Seed.
- G The bigger end of the Epididymis turgid with Seed.
- H The lesser end likewise turgid with Seed.
- I The end of the Epididymis or the beginning of the Vas deferens.
- K The Vas deferens of a Dog tied before the Coitus the Preparing vessels being unhurt, that the Seminary vessels being filled with Seed may be seen more apparently.

CHAP. XXII.

Of the Vasa deferentia, Vesiculæ seminales, and Prostatæ.

Vasa deferentia.

OUT of the *Epididymida* at their smaller end arise the two *Vasa deferentia*, or *Ejaculatoria*, being but a continuation of them. They are white, hardish bodies, like a pretty large Nerve, with a Cavity not very discernible, but which may be made so, if one open one of them six or seven fingers breadth above the Testicle, and then either blow into it with a small pipe, or squirt some colour'd liquor into it with a Syringe towards the *Testis*, for then the Vessel will be distended, and the colour will run along its Cavity towards the *Epididymida*: Or if you either blow, or squirt liquor by a Syringe the other way towards the *Vesicula seminales*, the said *Vesicula* will be distended. Now from the *Epididymida* these *Vasa deferentia* ascend, and pass out of the Cod into the *Abdomen* the same way by which the *Vasa præparantia* came down, viz. by the process of the *Peritoneum*. When they are entered the *Abdomen*, they are carried presently over the Ureters, and turning back again they pass to the backside of the Bladder; between which and the *Intestinum rectum* they march till about the neck of the Bladder, being somewhat severed, where they grow wider and thicker; and then just as they are going to meet, their sides open into the *Vesicula seminales*, in which they deposite the Seed; but not terminating

minating here, but coming close together and growing smaller and smaller, they go on and end at the *Urethra* betwixt the *Prostata*.

These *Vesiculae* are little Cells like those in a *Vesiculae* Pomegranate, or something like a bunch of *seminales*. Grapes; *De Graef* compares them to the Guts of a little Bird diversly contorted. They consist of one thin Membrane, through which some small twigs of both Veins, Arteries and Nerves run. They are about three fingers breadth long, and one broad; but in some places broader and some narrower, as they run in and out. They are two, (one for each *Vas deferens*) divided from one another by a little interstice; and they do severally by a peculiar passage emit the Seed contained in them into the *Urethra*. They are very anfractuous and winding, and (as was said) consist of many little Cells, that they should not pour out all the Seed contained in them, in one act of copulation, but might retain it for several. They have no communication one with another; not even in their very opening into the *Urethra*; but the Seed that is brought to the *Vesiculae seminales* on the right side by the right *Vas deferens*, issues by its proper passage into the *Urethra*; and that which is brought to the left, likewise. So that if by any accident the *Vesicula* on one side be burst or cut (as in cutting for the Stone they must needs be) yet those on the other being entire may still suffice for generation. Now when the Seed is emitted out of these *Vesiculae* in the act of generation, it passes out the same way it came in; which in this case may easily be, (though it be unusual there should be a contrary motion in the same Vessel) for as it comes in from the *Vasa deferentia*, it

drills along gently without any force; but *in Coitu* when the Muscles of the Yard and all the bordering parts are much tumified, it is expressed or squirted out of them with some violence, and passing along their neck, (which is a continuation of the *Vasa deferentia*) ouzes through a Caruncle (like Quick-silver through Leather) into the *Urethra*, or the Duct of the Yard that is common both to the Seed and Urine. I say it ouzes from the necks of the *Vesicula* through a Caruncle into the *Urethra*, for there is one plac'd as a Valve before the orifice of each of them; partly to hinder the coming of the Urine into them, partly to hinder the involuntary effusion of the Seed.

Now though naturally the little holes through which the Seed passes out of the necks of the *Vesicula* into the *Urethra* be almost imperceptible; yet if they be either eroded by the acrimony of the Seed (such acrimony as is contracted by impure embraces, or in Claps as we call them) or if of themselves they be debilitated and so become more lax (as sometimes happens to old or impotent Men that meddle too much) then there happens a *Gonorrhœa* or continual efflux of Seed. And so *Vesalius* and *Spigelius* have observed them much dilated, in dissecting such as have died with a *Gonorrhœa* upon them.

Prostatz.

The *Prostata* (in English *standers by* or *waiters*) are placed near to the *Vesicula seminaria*; *de Graec* calls them *Corpus glandosum*, supposing them to be one body, and only divided by the common Ducts of the *Vesicula seminales* and *Vasa deferentia* coming through the midst of it. They are of a white, spongy and glandulous substance, about as big as a small Walnut, encompass'd with a strong

strong and fibrous Membrane from the Bladder, to the beginning of whose neck they are joined at the root of the Yard. In shape they come nearest to an oval, save that on their upper and lower part they are a little depressed, and in that end by which the *Vasa deferentia* enter, they are something hollow like a Tunnel. The Sphincter muscle of the Bladder encompasses them, so that for so far as they cover the neck of the Bladder, the Sphincter touches it not, they coming between. They have all sorts of Vessels, which run mostly on their outer side. In their inner part they have ten or more small Ducts which all unload themselves into the *Urethra* by the sides of the great Caruncle (through which the Seed passes from the *Vesicula* into the *Urethra*) but themselves have each one a small one to stop its orifice lest the liquor that is contained in the Prostates should continually flow out, or the Urine should flow in. And these small Ducts I suppose are continued from those small *Vesicula* which appear in the Prostates of those that die (any way) suddenly after having had to doe with a Female. For in such, the spongy part of the *Prostata* is very turgid with a serous liquor, and in their inner part may be found these same *Vesicula*, like to *Hydatides*, which if you press upon, they will discharge themselves into the abovesaid Ducts.

What the liquor they contain should be, or *Their use*, what is their use, there is great variety of opinions. Some think that the Seed that flows from the Testicles is further elaborated here. But that cannot be; for that the *Vasa deferentia* deposite nothing in them, but all into the *Vesicula seminales*. Others think that from the Bloud there is separated

ted in them an acrimonious and serous humour, which serves for titillation or causing the greater pleasure in Venery. As to this, *de Graef* appeals to the tast of it, which has nothing of acrimony. *Dr. Wharton* thinks they make a particular kind of Seed, as the Testicles do another, and the *Vesicula seminales* a third. That these last make a Seed different from that made in the Testicles is grounded on a mistake in Anatomy, viz. that the *Vasa deferentia* have no communication with the *Vesicula*, whereas they apparently open into them, and deposite in them all the Seed they contain. That the *Prostata* make a peculiar sort, he endeavours to prove, because gelded Animals emit some Seed. But that is but precarious; for though they emit something, 'tis not necessary it should be any true Seed. Or if it be, it may well be supposed to proceed from the *Vesicula seminales* that have been full when the Animal was pelt. For, for this reason it has been observed that presently after gelding they have sometimes got the Female with young, but not afterwards when that stock was spent. *Bartholin* with many others thinks they make an oily, slippery and fat humour, which is pressed out, as there is need, to besmear the *Urethra*, whereby to defend it from the acrimony of the Seed and Urine, and lest it should dry up. *Diemerbroeck* confesses that it is necessary the inside of the *Urethra* should be kept moist and slippery, but thinks that that is done here as in the Bladder, Intestins and many other places, namely from some mucid part of the nourishment of the *Urethra* it self; and concludes that the *Vasa deferentia* deposite not all the Seed into the *Vesicula seminales*, but
 carry

carry a smaller part to these *Prostata*. *De Graef* denies that the *Vasa deferentia* convey any thing to them or have any communication with them; and therefore believes, that the humour that is separated in the *Corpus glandosum* (as he calls the *Prostata*) serves for a Menstruum or Vehicle of the Seed, which flowing but in small quantity through small pores into the *Urethra*, it was necessary that this humour should be mixt with it that it might better reach the Womb. Whatever this humour be, it is squeezed out partly by the intumescence and erection of the *Penis*, and partly by the compression of the Sphincter of the Bladder that girds the *Prostata* about.

These *Prostates* are often (at least partly) the seat of the *Gonorrhœa*; and the humour that they contain, that which is shed: for, if it were true Seed, they could never endure a *Gonorrhœa* so long (some, thirty years) without more notable weakning and emaciating, the flux being so large as sometimes it is.

I shall here omit all philosophical enquiries into the nature of the Seed, contenting my self purely with the Anatomical part.

The distance betwixt the root of the *Cod* and *Perinæ-*
the *Podex* is called *Perinaum*, à *perisio*, *circumfluo*, ^{um.}
because it is still moist with sweat. The *Pubes*, ^{Why these}
Scroton, and *Perinaum* in Men, are furnished with ^{parts in}
Hair, because Glandules are placed there, which ^{men are} hairy.
receive plenty of superfluous moisture: a part
whereof they send to the Skin for the generation
of Hair.

CHAP. XXIII.

Of the Tard.

THE Seed being elaborated and treasured up in the aforeſaid Organs, there was need of a peculiar Inſtrument whereby it might be conveyed into the Womb of the Female; and to this purpoſe Nature has furniſhed the Male with a Yard which we come now to anatomize.

Its name.

It is called in Latin *Penis*, *a pendendo*, becauſe it hangeth without the Belly. Alſo *Virga*, *Membrum virile*, *Vetrum*, *Mentula*, and by many other names invented by luſtfull perſons and laſcivious Poets.

Deſcription.

It is an Organical part, long and round, yet ſomewhat flat in the upper part, ſeated about the lower part of *Oſ pubis*, appointed partly for making of water, but principally for conveying the Seed into the Matrix.

Magnitude.

As to its thickneſs or length, it differs much in divers Men. But it is generally obſerved to be larger in ſhort Men, and ſuch as are not over much given to Venery; alſo in thoſe that have high and long Noſes, and that are ſtupid and half-witted.

It is neither bony, as in a Dog, Fox, Wolf; nor griſſy nor fleſhy; but is framed of ſuch a ſubſtance as might admit of diſtention and relaxation.

Parts.

The parts of it are either *common* or *proper*.

The *common* are three, the Scarf-skin, the Skin, and the *Membrana carnoſa*.

It

It hath no fat, for that would have hindred its erection into that stiffness that is necessary; and secondly would have occasion'd it to grow too bulky; and lastly would have dull'd that great pleasure that in Venery the Male is affected with in this part.

*Why it
hath no fat.*

The *proper* or internal parts are these: the two Nervous bodies, the *Septum*, the *Urethra*, the *Glans*, four Muscles and the Vessels.

The Nervous bodies (so called) are encompassed with a thick, white, nervous and very firm Membrane. (like an Artery) but their inner substance is spongiouse, being mostly a texture of Veins, Arteries and Nervous fibres, woven one with another like a Net; and when the Nerves are filled with Animal spirit, and the Arteries with hot and Spirituous blood, then the *Penis* is distended and becomes erect: but when the Spirits cease to flow in, then the Bloud and remaining Spirits are absorbed by the Veins, and so the *Penis* becomes limber and flaggy.

*The nervous
bodies.*

They spring from the lower side of the *Os pubis* at distinct originals, where they appear like two horns, or are of a figure resembling the Letter Y, that the *Urethra* may have room to pass between them. When they leave the *Os pubis* they are each covered with a several Membrane, and are afterwards joined together with only the *Septum* between, which the nearer it comes towards the *Glans*, is the thinner, so that before it come to the middle of the *Penis* its Fibres extend towards the back of the Yard from the *Urethra* in order like a Weaver's Slay, and while it still goes further, its Fibres by degrees grow so very small, that near the *Glans* the *Septum* is almost obliterated,

rated, and the two Nervous bodies grow into one. Whence it is that the *Penis* is equally erected; for if the *Septum* had exactly distinguished one part from the other, it might sometimes have so happened by the compression or obstruction of the Arteries of the one or the other side, that one part of it would have been extended, and the other remained flaccid.

Dr. *Wharton* affirms, these Nervous bodies have Glandulous flesh within them, which keeps the Yard something plump even when it is not erect. But *de Graef* denies this, and demonstrates that they have no other substance than before said, thus. Let the Yard be prepared thus: First gently squeeze the blood out of it, which it always has in greater or lesser plenty, and then put a little Tube into the spongy substance, namely in at that end that is next to the *Os pubis*; and let the Cavity of the *Penis* be half fill'd with water by the help of a Syringe, and shake the *Penis* with the water in it: pour out that bloody water, and fill it again with clear, and so three or four times till the water is no longer stain'd with blood. Then betwixt two Linen cloths squeeze out what water is in the Nervous bodies, and at length blow up the *Penis* so long till it have its natural bigness; in which posture if you will keep it, you must tie it hard. When the *Penis* is thus distended and dried, you may examine it as you please, and will find no other substance than was mentioned. *Diemerbroeck* says that their substance is not a meer texture of Vessels, but is fibrous, fungous and cavernous (such as is the substance of the Lungs) receiving in their hollow Interstices Blood and Spirits out of the Vessels that are dispersed through their substance.

Below

Below these Nervous bodies lies the *Urethra*, being of a much like substance to them, saving that its spongy part, which is outer and lower, hath less pores because of its smaller and more plentiful Fibres. This part does tumefy whenever the Nervous bodies do. Its inner part is membranous, round and hollow, and exceeding sensible. It is of an equal largeness from one end to the other, save in its fore-part, where the *Glans* is joined to the Nervous bodies, for there it hath a small Cavern, into which the acrimonious Urine lighting in the Stone of the Bladder, while it wheels about in it, causeth pain, and is a great sign of the Stone. Sometimes also the acrimonious eroding liquor in a *Gonorrhoea* staying here, doth cause a most tormenting ulceration.

The Urethra.

It is continuous to the neck of the Bladder, but has not its rise from it, nor is of the same kind of substance. If you boil the Bladder and it, it will easily separate, and appears of a clear other substance and colour. It begins at the neck of the Bladder and reaches to the end of the *Glans*, which it seems to bestow a Membrane upon from its own inner one, for it is plainly continued from it.

Its use is to convey along the Seed and Urine. And to that end there open into it small pores that transmit the Seed into it from the necks of the *Vesicula seminales* (of which in the foregoing Chapter;) and also the neck of the *Vesica Urinaria* which pours out the Urine into it, at which place it has a membranous Valve, of which likewise before in Chap. 19.

The Muscles are two in each side, and so four Muscles.
in

in all. Of these one pair are called Collateral muscles, by others *Erectores*. These are shorter and thicker, and spring from the *appendix* or knob of the *Coxendix*, under the beginning of the Nervous bodies, and are inserted into the same, a little from their beginning. These serve for erection of the *Penis*.

The second pair is longer and smaller, proceeding from the sphincter of the *Anus*.

These pass streight by the sides of the *Urethra*, and are inserted about the middle of it, which they serve to dilate for miction and ejaculation of the Seed, and are called *Dilatantes*, wideners, and *Acceleratores* or hastners.

These have been generally held to be the uses of these Muscles, but *de Graef* (as also *Swammerdam*, *not. in prodr. p. 35.*) assigns a clear contrary to them, and that with great shew of reason. For seeing the action of a Muscle is contraction, how should the former pair extend the *Penis*, and not rather draw it back towards their original? Or how should the latter serve to dilate the *Urethra*, and not rather straiten it, seeing in the action or contraction of a Muscle its Belly or Middle swells? Therefore he says that the Muscles only contribute thus far or in this respect to the extension or erection of the *Penis*, in as much as by their swelling (partly by bloud and spirit flowing into them, partly by their proper action) they serve to straiten and compress the roots of the Nervous bodies and the spongy part of the *Urethra*, and so drive the Blond that flows in by the Arteries towards the *Glans*, and hinder its returning back again by the Veins: even as we daily see in a piece of a Gut, which if we fill with

wind

wind or water, and then compress one end, we shall see the other strut out and be more distended.

The end or head of the *Penis* is called *Glans*, *Glans*. and *Balanus*. Into this the Nervous bodies terminate, and being a little thicker (on that side next them) than they, it encompasses them with a circle like a Crown. On its fore-part it is smaller and sharper. It has a peculiar substance (Dr. Wharton says glandulous) soft and spongy, and being covered with a very thin Membrane produced from the internal one of the *Urethra* (which coming out of its hollow, dilates it self so as to cover all the *Glans*) it thereby and from its proper substance, much interwoven with Nerves, becomes most exquisitely sensible, and is the principal seat of pleasure in copulation. Which if it had not been very great, who would have taken delight in so brutish a thing as Venery? To this purpose *Andreas Laurentius* elegantly, (*Ahat. lib. 7. cap. 1. q. 7.*) "Who (most strange!) would have solicited or accepted of so vile and filthy a thing as lying with a Woman? "with what face would Man, that divine Animal, full of reason and counsel, have handled the obscene parts of Women polluted with so much filth, which is discharged into this low place as into the common sink of the Body? On the other side, what Woman would have accepted of the embraces of a Man, considering the toil and tediousness of going 9 months with Child, the most painfull and often fatal bearing of it, and its education full of care and anxiety, unless the Genitals had been affected in the act with transporting pleasure?

Præputium.

The *Glans* is covered with the *Præputium*, or Fore-skin, which is framed of the reduplication of the Skin.

It is called *Præputium*, because it is placed *præpudendo* before the Yard: or rather *à præputando*, from being cut off, for this is that which the Jews cut off in Circumcision, from whence they are called *Apella* and *Recutiti*. And it is reported by divers persons from their own inspection, that in Jewish Children it is six times as large as in Christians, and hangs a great way over the *Glans*, before it be cut off.

Frenum.

The Ligament by which the Fore-skin is tied to the *Glans* in the lower part of it, is called *Frenum*, the Bridle.

The Vessels.

Of the Vessels, some are cutaneous, some pass to the inner parts of the *Penis*.

Veins and Arteries.

The cutaneous veins and arteries spring from the *Pudenda*; these entering at the root of the Yard, pass by the sides towards the back of it, and are conspicuous enough. The Vessels which are bestowed upon the inner parts of it, come from the *Vena* and *Arteria hypogastrica*, and enter just at the meeting of the two Nervous bodies, through whose length they run, and are mostly dispersed in them, and in the fungous part of the *Urethra*, sending forth little twigs at the sides.

Nerves.

It has two Nerves from the lowest Vertebral. The greater of them, that is very large and long, is distributed into the Nervous bodies, *Urethra* and *Glans*; the lesser upon its Muscles. Concerning which Dr. *Willis* thus discourses. "This Member (says he) having only Nerves from the Spinal marrow, should only have a spontaneous motion according to our Hypothesis (*viz.*

“(viz. that the Nerves from the Brain serve for natural, and the Vertebral for voluntary motion.) And yet through the turgescency of the Genital humour, it is often erected and filled with Spirit against ones mind ; which is from hence, because from this Vertebral pair, whence the Nerves of the *Penis* spring, a sprig is reached forth to the Vertebral pair next above it, viz. in which is radicated the *Plexus* that is placed in the *Pelvis* and bestows Nerves on the *Prostata*, into which *Plexus* also a notable Nerve is implanted from the Intercostal pair. Seeing therefore there is a communication between the *Prostata*, (which depend much on the Intercostal Nerves) and the *Penis* it self (by reason of the insertion of the aforesaid sprig into the *Plexus* from whence the *Prostata* have their Nerves) hence it comes to pass that it acts accordingly as they are affected. But they, (viz. the *Prostates*) are not only apt to be moved by the turgescency of the Seed ; but, by the communication of the Intercostal nerve, according to the impressions made on the Senses or Brain, are wont to be irritated by too importune an action ; into consent wherewith the *Penis* is presently excited.

Its principal use is to convey the Seed into the *Use*. *Uterus* of the Female ; and its use to piss withall, is but secondary, for many Creatures (as Fowls in general) make no water by it, yet have a *Penis* for the use abovesaid.

That part that is next above it towards the Belly is called the *Pubes*, and its lateral parts are called the Groins ; both which places in the Mature are covered with hair, whereby Nature

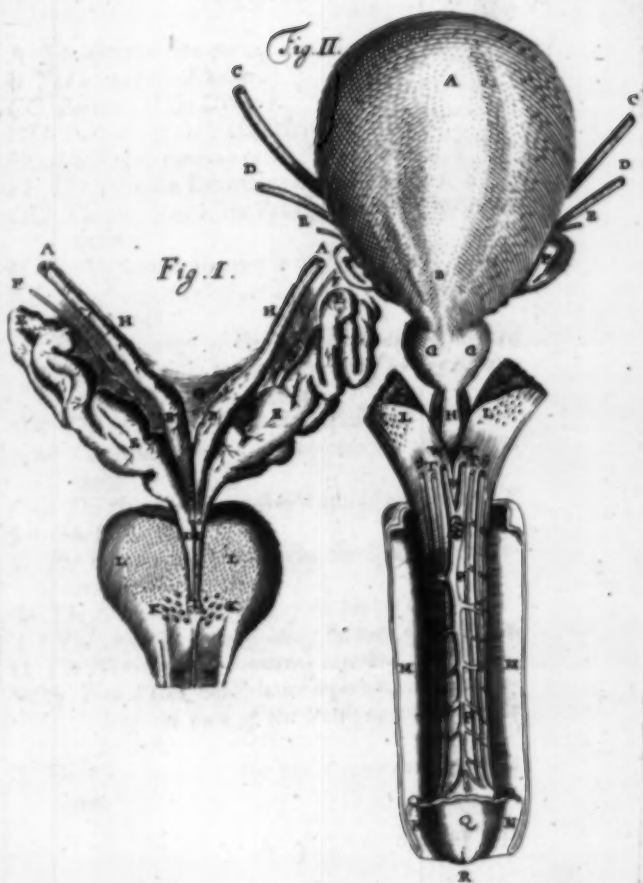
would in some measure veil the Privities, seeing natural modesty requires it.

The Explanation of the Table.

Figure I.

- AA Parts of the Vasa deferentia, which appear thick, but have only a small Cavity.
- BB The parts of the Vasa deferentia of a thin substance and large Cavity, being widened.
- CC The extremities of the Vasa deferentia narrowed again, and gaping each with a little hole into the neck of the Seed-bladders.
- DD The neck of the Seed-bladders parted from each other by a Membrane going between, so that the Seed of one side cannot be mixed with that of the other, before it come to the Urethra.
- EE The Vesiculæ seminales or Seed-bladders blown up, that their wonderfull widenings and narrowings may be seen.
- FF Vessels tending to the Seed-bladders.
- GGG The Membranes whereby the Seed-bladders and Vasa deferentia are kept in their places.
- HH The Sanguinary vessels running by the sides of the Vasa deferentia.
- I A Caruncle resembling a Snipe's beak, through whose eyes as it were the Seed issues out into the Urethra.
- KK The Ducts of the Corpus glandosum or Prostata opening into the Urethra by the sides of the Caruncle.
- LL The Corpus glandosum divided.
- MM The Urethra opened.

Figure II.



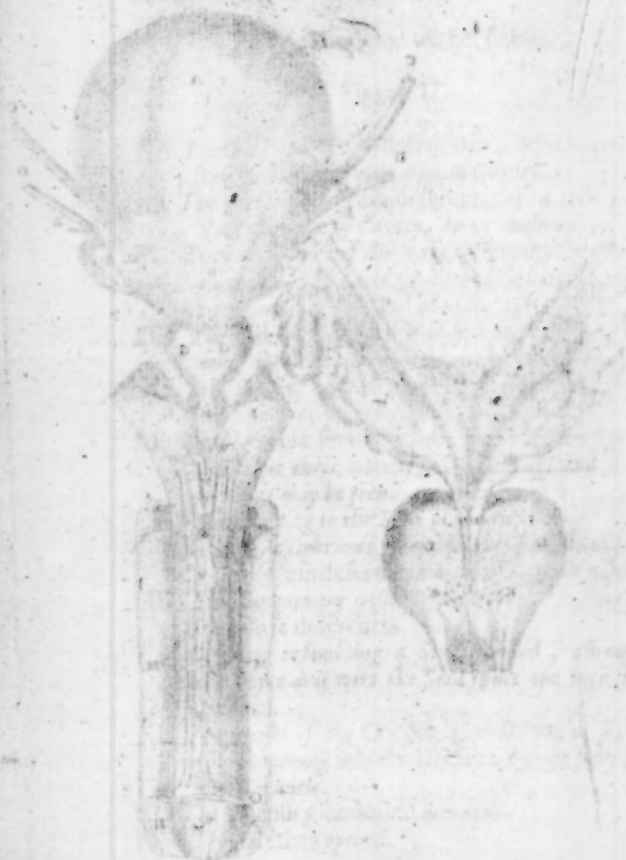


Figure II.

- A The upper or fore-part of the Bladder.
- B The neck of the Bladder.
- CC Portions of the Ureters.
- DD Portions of the Vasa deferentia.
- EE The Vessels running to the Seed-bladders.
- FF The Vesiculæ seminales or Seed-bladders.
- GG The fore-part of the Prostate or Corpus glandosum.
- H The Urethra adjoining to its spongy part.
- KK The Muscles called the Erectors or Extenders of the Penis.
- LL The beginnings of the Nervous bodies separated from the Ossa pubis, which puff up like Bellows when the Yard is erected.
- MM The Skin of the Penis drawn aside.
- NN The duplicature of the Skin making the Præputium.
- OO The Skin that was fasten'd behind the Glans.
- PP The back of the Penis.
- R The urinary passage whereby the Glans is perforated in its fore-part.
- SS The Nerves running along the back of the Penis.
- TT The Arteries running along the back of the Penis.
- U The Nervous bodies meeting together.
- WW Two Veins which unite together, and run along the back of the Penis in a remarkable branch.
- X The Vein opened, that the valves in it may be seen.

Of the GENITALS in Women.

CHAP. XXIV.

Of the Vasa præparantia.

THough it has been the method of divers Anatomists to begin with the description of the outer parts of the Privity; yet because we would observe, as much as may be, the same order in Women as we have in Men, we shall first begin with the Spermatick vessels, which are of two sorts, *Arteries* and *Veins*.

*Sperma-
tick arte-
ries.*

The Arteries are two, as in Men. They spring from the great Artery a little below the Emulgent (very rarely either of them from the Emulgent it self) and pass down towards the Testes not by such a direct course as in Men, but with much twirling and winding amongst the Veins, with which tho' they have no inosculation, as has been generally taught. But for all their winding, when they are stretcht out to their full length, they are not so long as those of Men; because in them they descend out of the *Abdomen* into the *Scrotum*, but in Women they have a far shorter passage, reaching only to the *Testes* and Womb within the *Abdomen*.

Veins.

The Veins are also two, arising, as in Men, the right from the trunk of the *Cava* a little below the Emulgent, the left from the Emulgent it self. In their descent they have no more bendings than in Men, and therefore are considerably shorter.

Both

Both the Arteries and Veins as they pass down are cover'd with one common Coat from the *Péritonæum*; and near the *Testes* they are divided into two branches, the upper whereof is implanted into the Testicle by a triple root; and the other is subdivided below the *Testes* into three twigs, one of which goes to the bottom of the Womb, another to the *Tuba* and round Ligament, the third creeping by the sides of the Womb under its common Membrane, ends in its neck, where it is woven with the Hypogastrick vessels like a Net. By this way it is that the *Menstrua* sometimes flow in Women with Child for the first months, and not out of the inner Cavity of the *Uterus*: but yet that Blood does not flow at that time so much by the Spermatick Arteries as by the Hypogastrick.

The use of these Spermatick vessels is to minister to the (generation of Seed, according to the ancient doctrine; but) nutrition of the Eggs in the *Ovaria* or *Testes* (according to the new) the nourishment of the *Fœtus*, and of the solid parts, and the expurgation of the *Adenses*; inasmuch as Blood is conveyed by the Arteries to all those parts to which their ramifications come, in which parts they leave what is to be separated according to the law of Nature, the remaining blood returning by the Veins. *Their use.*

CHAP. XXV.

Of Womens Testicles or Ovaria.

Womens Testicles differ much from Mens both in their situation, figure, greatness, covers, substance, and also use.

Their Situation.

First, their situation is not without the Body, as in Men, but in the inner Cavity of the *Abdomen*, on each side two fingers breadth from the bottom of the Womb, to whose sides they are knit by a strong Ligament, that has us'd to be called and accounted the *Vas deferens*; as if the Seed were carried by it from the *Testes* to the Womb. Of which afterwards.

Figure.

They are flat on the sides; in their lower part oval, but in their upper (where the Bloud-vessels enter them) more plane. Their superficies is more rugged and unequal than in those of Men. They have no *Epididymides*, nor *Cremaster* Muscles.

Greatness.

They differ in bigness according to age. In those newly come to maturity they are about half as big as those of Men; but in those in years they are less and harder. Preternaturally they sometimes grow to a vast bigness from Hydropical tumours, in which several quarts of serous liquor have been found to be contain'd.

Tunicle.

They have but one Membrane that encompasses them round; but on their upper side, where the *Vasa preparantia* enter them, they are about half way involved in another Membrane that accompanies those Vessels, and springs from the *Peritoneum*.

When

When this cover is removed, their Substance *Substance;* appears whitish, but is wholly different from the substance of Mens Testicles. For Mens (as was said above) are composed of Seminary vessels, which being continued to one another are twenty or thirty Ells long if one could draw them out at length without breaking: But Womens do principally consist of a great many Membranes and small Fibres loosely united to one another; amongst which (in the outer superficies of the *Testes*) there are several little Bladders (like to *Hydatides*) full of a clear liquor, through whose Membranes the Nerves and *Vasa praparentia* run, and are obliterated in them. The liquor contained in these Bladders had always been supposed by the followers of *Hippocrates* and *Galen* to be Seed stored up in them, as if they supplied the place of the *Vesicula seminales* in Men. But from Dr. *Harvey* downwards many learned Physicians and Anatomists (according to *Aristotle*) have denied all Seed to Women. Of which the said Dr. *Harvey* thus discourses, *De ovi materia, Exercit. 34.* "Some Women send forth no such humour as is called Seed, and yet is not conception thereby necessarily frustrated; for I have known several Women (says he) that have been fruitfull enough without such emission; yea, some that after they begun to emit such humour, though indeed they took greater pleasure in copulation, yet grew less fruitfull than before. There are also infinite instances of Women, who though they have pleasure in coitu, yet send forth nothing, and notwithstanding conceive. I greatly wonder that they that think this emission necessary to generation, have

“ have not observed, that the humour is cast out,
 “ and issues most commonly from about the *Clitoris*
 “ and orifice of the Privity ; very seldom
 “ from any depth within the neck of the Womb,
 “ but never within the Womb it self, so as that it
 “ should there be mixed with the Man’s Seed ; and
 “ that it is not ropy and oylly like Seed, but serous
 “ like Urine. Now to what purpose should that
 “ be cast out, whose use is necessarily required
 “ within ? Ought that humour to be sent to the
 “ mouth of the Privity, (bidding farewell as it
 “ were to the Womb) that it might be drawn
 “ back again with the greater kindness and wel-
 “ come ?] And indeed whatever that humour
 be that the more salacious Women emit in copu-
 lation, (of which afterwards) it cannot be that
 which is contained in these *Vesiculae*, both be-
 cause it is sent forth in greater quantity than that
 it can be supplied from them, and also the *Vesiculae*
 are destitute of any such pore or passage whereby
 the liquor contained in them might issue out ;
 for if you press them never so hard, unless you
 burst them, there will nothing pass out of them.
 We must therefore subscribe to that new but ne-
 cessary opinion that supposes these little Blad-
 ders to contain nothing of Seed, but that they
 are truly Eggs, analogous to those of Fowl
 and other Creatures ; and that the Testicles
 (so called) are not truly so, nor have any
 such office as those of Men, but are indeed
 an *Ovarium* wherein these Eggs are nourished
 by the Sanguinary Vessels dispersed through
 them, and from whence one or more (as they
 are fecundated by the Man’s Seed) separate,
 and are conveyed into the Womb by the

Tuba

Tuba Fallopiana, of which by and by.

That these *Vesiculae* are analogous to the little Eggs in the *Ovarium* of Fowl, *de Graef* evinces by this Experiment, That if you boil them, their liquor will have the same colour, taste and consistency with the white of Birds Eggs. And their difference in wanting shells is of no moment; for Birds Eggs had need of a shell, because they are hatched without the Body, and therefore are exposed to external injuries; but these of Women being fostered within their Body, have no need of other fence than the Womb, by which they are sufficiently defended.

Having compared these *Vesiculae* to the Eggs of Fowls, I might here follow the method of Doctor *Harvey* and *de Graef*, and describe the *Ovarium*, &c. in Hens, &c. that from thence these in Women might the better be conceived of and apprehended; but to the curious and learned Reader I shall recommend the said Authors for satisfaction, and avoiding all unnecessary and (to this Epitome) unsuitable excursion, I shall only further note two things: First, that these Eggs in Women are commonly towards the number of twenty in each Testicle or *Ovarium*, of which some are far less than others. And secondly, that the objection of the Galenists against the Aristotelians, (*viz.* that the *Testes* of Females must needs make Seed, because when they were cut out, barrenness always follow'd) will be sufficiently obviated by this new Hypothesis, that agrees to the necessity of the Testicles so far as to affirm that the *Vesiculae* contained in them become (when they are impregnated by the Masculine Seed) the very conceptions themselves, which there-

therefore it would be in vain to expect if the Female were castrated.

Besides the *Vasa preparantia*, and Nerves, (of which in the 27th Chapter) they have also Lympheducts, according to Dr. Wharton.

CHAP. XXVI.

Of the Vasa deferentia in Women, or their Oviducts.

Galen with most of the Ancients reckoned those short processes that go streight from the *Testes* to the bottom of the Womb, to be *Vasa deferentia*; and that the Seed was emitted from the Stones through them into the *Fundus uteri*. And *Fernelius*, *Riolanus*, &c. thought they found a small Pipe passing on each side out of these processes by the sides of the Womb to its neck, into which they were inserted and opened near its orifice. By the former it was supposed Women not with Child did emit their Seed into the bottom of the Womb; and by these latter such as were already impregnated: for that, if it should have issued into the *Fundus* where the conception was, it would there have corrupted to the great prejudice of the *Fetus*.

But as to these latter ducts, *Veslingius*, *Diemerbroeck*, *de Graef* and many other accurate Anatomists, have not been able to find the least footstep of them. And as for the former, seeing they are not pervious, nor have any Cavity, (and therefore

therefore can have nothing of Seed in them) we must conclude with *de Graef* that they are only Ligaments of the Testicles to keep them in their place; which he evinces further by observing, that they come not to the inner Cavity of the *Uterus*, but are knit only to its outer Coat: for he says, there are only two holes in the *Fundus uteri* that admit a Probe, and those lead to the *Tuba Fallopiana* and not to these Ligaments.

Seeing therefore that those which have been accounted *Vasa deferentia* either are not to be found at all, or are found incapable of such an office; and having withall rejected the opinion of Womens having Seed, and affirmed that that which makes the conception is one of those *Vesiculae* in the *Testes*, dropping from thence and conveyed into the Womb, we must inquire by what way they can pass. For if the abovesaid Ligaments (reputed *Vasa deferentia*) have no passage whereby even the *Semen*, if there were any, might pass; much less could one of these *Vesiculae* be conveyed that way. And therefore for *Vasa deferentia* we assign those ducts that *Fallopins* in his Anatomical observations calls *Tuba*, and describes thus: "They are very slender and narrow ducts, nervous and white, arising from the horns (or sides) of the Womb, and at a little distance from it they become larger, and twist like the tendrel of a Vine, till near their end, where ceasing their winding they grow very large; and seem membranous and car-nous. Which end is very much torn and jagged like the edge of rent Clothes: and has a large Foramen, which (says he) always lies closed, because those jags fall together; but yet being opened

Tubæ Fal-
lopianæ.

“opened they are like the utmost orifice of a Brass Trumpet.] But *de Graef* says, though they grow very large towards their end, yet of a sudden the very extreme part is narrowed before it is divided into the aforesaid jags, which he resembles unto leaves. Who also appeals unto experiment for these *Tuba*’s being pervious, affirming that if one put a little Tube into the beginning of one of these same Trumpets and blow it, the wind will presently break through it, which he saith he has observed in all the kinds of Animals that he has dissected.

“These *Tuba* (according to *Dr. Harvey*) are the same in Women that the *Cornua* or Horns of the Womb are in other Creatures. For they answer to those both in situation, connexion, amplitude, perforation, likeness and also office: for as other Animals always conceive in the *Cornua*, so it has been sometimes observed (as by *Riolanus* from others; and by himself) that a conception has in a Woman been contained in one of the *Tuba*.] Which must have happened, when the *Ovum* being received out of the *Festis* into it, has been stopt in its passage to the Womb, either from its own bigness, or some obstruction in the *Tuba*.

Their substance.

Their substance is not nervous (as *Fallopium* in the above-recited description affirms) but membranous. For they consist of two *Membranes*, the *outer* and *inner*. The *inner* springs from (or at least is common with) that which covers the inner substance of the Womb; but whereas it is smooth in the Womb, it is very wrinkled in the *Tuba*. The *outer* is common with the outmost of the Womb; and this is smooth.

The

The capacity of these ducts varies very much; *Width.* for in the beginning as it goes out of the Womb, it only admits a bristle, but in its progress where it is largest it will receive ones little finger. But in the utmost extremity where 'tis divided into jags, it is but about a quarter so wide.

They are very uncertain also in their length; *Length.* for from four or five, they sometimes encrease to eight or nine fingers breadth long.

Their *use* is, In a fruitfull copulation to grant *Use.* a passage to a more subtile part of the Masculine seed (or to a seminal air) towards the *Testes*, to bedew the Eggs contained in them; which Eggs (one or more) being by that means fecundated (or ripened as it were) and dropping off from the *Testis* (in the manner as shall be described Chap. 30.) are received by the extremity of the *Tuba*, and carried along their inner Cavity to the *Uterus*. For Dr. *Harvey* affirms that they have a worm-like or peristaltick motion like that of the Guts (*de Cervarum & Damarum Utero, Exercit. 65.*) And the same is affirmed by *Swammerdam, Not. in Prodr.*

Against this use two objections may be made; First, that the end of the *Tuba* not adhering close to the *Testis*, when one of the *Vesicula*, (or *Ova*, as we think they are) shall drop off from the *Testis*, it would more probably fall into the Cavity of the *Abdomen*, than light just pat in the mouth of the *Tuba*. Secondly, That when it is received by it, its duct is so narrow, that 'tis hard to conceive how it can pass by it.

As to the *first*; the same objection may lie against the use of the Oviduct or *Infundibulum* in Hens, for neither in them does it join quite close
to

to the *Ovarium*, (as *Swammerdam*, &c. truly observes) and yet it is certain that the *Vitelli* or little Yelks (or rudiments of the Eggs) do all pass by them to the *Uterus*. The same, *Swammerdam* observes also in Frogs, in one of whom there are many hundreds of Eggs, which all pass one after another from the *Ovarium* by the Oviduct or *Infundibulum*, and yet the mouth of the Oviduct is almost two fingers breadth from the *Ovarium*, and besides is immovable, whereas the *Tuba* in Women are at liberty (and are more than long enough) to embrace the *Ovarium* with their orifice: and we must believe that they do so when a conception is made; for it is not improbable that when all the other parts of the Genital are turgid in the act of Copulation, these *Tuba* also may be in some measure erected, and extend their opened mouth to the Testicle, to impregnate the *Ova* with the Seminal air steaming through their duct, and if any one be fecundated and separate, to receive it afterwards by its orifice.

As to the *second* objection, which urges the narrowness of these *Tuba*; He that considers the straitness of the inner orifice of the Womb, both in Maids and in Women with Child, and yet observes it to dilate so much upon occasion as to permit an egress to the Child out of the Womb, cannot wonder that to serve a necessary end of Nature the small duct of the *Tuba* should be so far widen'd as to give passage to an *Ovum*, seeing its proportion to their duct is many times less than of the Child to the usual largeness of the said orifice.

CHAP. XXVII.

Of the Uterus or Womb, and its Neck.

HAVING treated of the *Vasa praparanlia* (so called) that bring nourishment to the *Testes* or *Ovaria*, as also of these and their *Ova*, and lastly of the *Tuba* through which the *Ova* pass to the *Uterus*; we now come to the *Uterus* it self which receives the *Ova*, and in which the conception is formed, and the *Fætus* nourished till it acquire its due maturity and be fit for the birth.

The *Uterus* or Womb is usually divided into four parts, the *Fundus* or bottom, *Os internum* or *Cervix*, the *Vagina*, and the *Sinus pudoris* or outward Privity. Of each of these in order. And first of the *Fundus*.

This in a special manner is called the Womb, *Its name* because all the rest seem to be made for its sake. It is also called the *Matrix*, from its being as a Mother to conserve and nourish the *Fætus*; and likewise *Utriculus* from *Utris* a Bottle.

It is seated in the *Hypogastrium* or lowest part *Situation* of the *Abdomen*, in that large hollow that is called *Pelvis*, and is formed out of the *Ossa Ilii*, the Hip, the *Ossa pubis*, and the *Os sacrum*. In this Cavity it is placed between the Bladder and the streight Gut; so that Man being bred betwixt piss and dung if he would but consider his origine, might hence draw an argument of humility.

Its hindmost part is loose, that it might be ex- *Connexion* tended as the *Fætus* encreaseth. But its sides are tied fast by two pairs of Ligaments.

L

The

Ligaments.

The first pair are further from the *Os internum*, and are broad, arising from the *Peritoneum*. They have a membranous, loose and soft substance, and for their shape are resembled to Bats wings. They tie the sides of the *Fundus*, the *Testes* and a good part of the *Tuba* together, and are fasten'd to the *Ossa Ilii*, whereby the Womb is kept from falling down. But if they be either immoderately relaxed, or by any violence broken, then the Womb descends and sometimes falls out (turning inside outwards) if the substance of the Womb happen to be relaxed also.

The second pair arise nearer to the inner orifice of the *Vagina*, about where the *Tuba* do, and are called the round Ligaments, or worm-like. From their origine which is broad, they ascend on each side between the duplicature of the *Peritoneum* towards the Groins, and running out of the Cavity of the *Abdomen* become round, and then pass obliquely above the *Os pubis* towards the fat that is plentiful there (and makes the *Mons Veneris*) in which they terminate near the *Clitoris*, being divided into many parts. They consist of a double Membrane, the inner whereof has all sorts of Vessels, Nerves, Arteries, Veins and *Vasa lymphatica*; and are about a span long. *Veslingius*, *Diemerbroeck*, &c. say that they receive a small Seminal vessel from the *Testes* and *Tuba*, which they conduct to the *Clitoris* into which they are inserted, and ought rather to be accounted *Vasa deferentia* than Ligaments. So that what Women emit from about the *Clitoris* in copulation, they think to be true *Semen* conducted hither by those seminal ducts. But *de Graef* denies any such ducts, and affirms that these Ligaments reach
not

not the *Clitoris*, but are terminated in the afore-said fat. And that humour which Women emit (sometimes) he thinks doth issue out of the *Lacuna* in the orifices of the *Vagina* and urinary passage, or also from the *Meatus's* in the neck of the Womb. Which humour is supplied to the former parts from the thick and membranous body that is about the urinary passage; and to the latter from the nervous-membranous substance of the neck of the Womb. And indeed who can think Nature so prodigal of so spirituous and noble a liquor as Seed, as to ordain it to be shed at the orifice of the *Pudendum*, and so to be quite lost, and never mixed with the Mans, which is ejected into the bottom of the Womb? But we have above denied all Seed to Women; and therefore believe that the liquor they emit is only for the lubricating of the *Vagina* to cause the greater pleasure *in coitu*. But to this purpose more before.

Its *Substance* is whitish, nervous or rather membranous; dense and compact in Virgins, but in Women with Child a little spongy and soft. Substance.

It hath two *Membranes*. The outer is strong and double, arising from the *Peritoneum*: the inner, being proper, is fibrous and more porous. Membranes. Betwixt these Membranes there is a certain car-nous and fibrous contexture, which in Women with Child, together with the said Membranes, does imbibe so much of the nutritious humours that then flow thither, that the more the *Fœtus* encreaseth, the more fleshy, fibrous and thick doth the Womb grow; so that in the last months it becomes an inch thick, and sometimes two fingers breadth, though it be extended to so much greater compals than it has when a Woman is

not with Child. And yet (which is strange) within sixteen or twenty days after a Woman is brought to Bed, it becomes as thin as before (*viz.* about half a fingers breadth) and the whole contracts into so little a compass as to be held in ones hand.

Bigness.

In Virgins it is about two fingers breadth broad, and three long. In those that have lain with a Man it is a little bigger, and something larger yet in those that have born Children.

Figure.

In shape it is something like a Pear, only a little flattish above and below. But in Women with Child it becomes more round.

Cavity.

In Maids its Cavity is so small that it will hardly hold a large hazel nut. In those that have had Children it will hold a small walnut. It is divided into no Cells as it is in most viviparous Brutes, but only into the right and left side by a Suture or line that goes lengthways, much like that in a Man's Cod. Its Cavity is not quite round, but jets out a little towards each side; which jetting some call its Horns, but improperly: for though *Galen* (and many after him) having never dissected any Woman, presuming that their Womb was like that of other viviparous Creatures, attributed *Cornua* thereto, yet in truth they have none, but the *Tuba Fallopiana* (as was noted before) answer to them and do their office. Only in Brutes (*viz.* such as have *Cornua*) the conception is always formed in the *Cornua*, as being the greatest part of the *Uterus* (which from the very orifice of its *Fundus* is presently divided into them, as when one parts the fore- from the middle finger as wide as one can) but very rarely in the *Tuba* in Women, but most
an

an end in the *Fundus* it self. Of which more in Chap. 30.

Its Arteries spring partly from the *Spermatick* *Arteries*. or *Præparantes*, and partly from the *Hypogastrick*. These two Arteries do on each side by a notable branch inosculate one with the other. And both their branches that run on one side the Womb, do inosculate with those of their own stock on the other. Which may plainly be seen by blowing into the trunk of either of them on which side you will, for then the branches on the other side will be puffed up, as well as those on that side you blow.

They run along the Womb not with a streight or direct course but bending and winding; that they maybe extended without danger of breaking when the Womb is enlarged to so great a bulk by the *Fetus*. By these Arteries it is that the monthly Courses flow, in greatest quantity out of those that open into the *Uterus* it self, but in lesser out of those branches that reach and open into the *Cervix* or neck of the Womb, and in least (if at all) out of the *Vagina*. Now whether the Bloud be sent forth this way at such times only from the two great quantity of it; or whether at such stated seasons there is also a fermentation of the Bloud whereby the orifices of the Arteries are unlocked, is a controversie of two large consideration for this place. We will only say that the latter is more probable, because when a Woman feeds high, and so breeds much Bloud, they flow never the sooner (though it may be in greater quantity) and when she uses the greatest abstinence and sparseness of diet (if she be healthfull) they will be never the longer of coming. So

that when through such effervescency the Blood flows plentifully into the Uterine vessels, and the Veins of the Womb being too few (for they are fewer than the Arteries) to return it all back again by the circulation, it bursts forth of the extremities of the Arteries so long, till the too great quantity of the Blood be lessen'd and the fermentation ceases, which it does after three or four days, and so the flux stops till the next period. In Women with Child they seldom flow, because then the redundant Blood is bestowed on the nourishment of the *Fetus*: and it is the wanting of the *Menses* at the usual season, that commonly gives Women the first *Item* of their having conceived. But of this also more in Chap. 30.

Veins.

The Veins do likewise spring from the *Præparantes* and from the Hypogastrick. There are many anastomoses of these Veins one with another, (as there was noted of the Arteries) but especially in the sides of the *Uterus*, which do more readily appear by blowing of them up, than those of the Arteries above spoken of. The Blood brought hither by the Arteries, that is not spent on the ordinary nutrition of the Womb, or is not cast out when the *Menses* flow, returns by these Veins back to the Heart.

Nerves.

It has Nerves from the *Plexus mesenterii maximus* of the Intercostal pair, and from the lowest *Plexus* of the same. As also from the Nerves of *Os sacrum*. And the same run also to the *Testes* or *Ovaria*. Now it is these *Plexus* of Nerves that are chiefly affected in the Hysterical passion, or Fits of the Mother. For these Fits are merely Convulsive, and often happen without any fault of the Womb at all. And that symptom that in
such

such Fits is usual, namely when something like a Ball seems to rise from the bottom of the Belly and to beat strongly about the Navel (which is usually taken by Women for the rising of the Womb or Mother) is nothing but the convulsion of these *Plexus* of Nerves : which one will the rather believe, when he considers that some Men are afflicted with the same symptom. Of which see more in Dr. Willis (in *Cerebr. anat.* p. 201.) who derives the pain of the Colick also from the same cause.

De Graef says there are many Lympheducts *Lympheducts* that creep through the outer substance of the *Uterus*, which one after another meeting into one empty themselves into the common Receptacle : And these he says, Bartholin mistakes for *Vena lactea*.

The use of the Womb is to receive into its capacity the principles of the formation of the *Fœtus*, to afford it nourishment, to preserve it from injuries, and at length when it is grown to maturity and requires the light and a freer air, to expell it forth.

The *Cervix* or *Os internum* of the Womb being *The neck of the Womb* contiguous to it and coming betwixt it and the *Vagina*, we will treat of it in this Chapter. It seems to be a part of the *Fundus* or of the Womb properly so called, only it is much narrower, for its Cavity is no wider in Virgins than a small Quill, and in Women with Child its inner orifice doth either quite close its sides together, or is daub'd up with a slimy yellowish humour, so that nothing can then enter into the Womb, unless in very lustfull Women it be sometimes open'd

in superficiation. It is an inch or more in length. Its Cavity as it opens to the *Vagina* is compared to the mouth of a Tench; *Galen* likens it to the *Glans* of a Man's *Penis*; for its Cavity is not round, but long and transverse. It is wrinkled, and has many small ducts opening into it, out of which one may press a pituitous serous matter. It has the same Membranes and the same Vessels with the *Uterus* itself. *De Graef* says that amongst its wrinkles he has often observed *Hydatides* or little watry Bladders; and thinks that abovesaid serous matter serves only to moisten the *Vagina*, &c. and to excite to Venery.

CHAP. XXVIII.

Of the Vagina, and its Contents, viz. the Hymen and Carunculae myrtiformes.

Its name.

IT has its name *Vagina* or Sheath, because it receives the *Penis* like a Sheath. It is called also the *door of the Womb*, and its *greater Neck*, to distinguish it from the lesser, just now described in the foregoing Chapter.

Description.

It is a soft and loose Pipe, uneven with orbicular wrinkles, of a nervous but somewhat spongy substance (which lust causes to puff up a little, that it may embrace the *Yard* more closely) about seven fingers breadth long, and as wide as the streight Gut: all which yet, both length, width and looseness differ in respect of age, &c. and as a Woman is inflam'd more or less with lust.

So

So also the aforeſaid wrinkles are much more numerous and cloſe ſet in Virgins, and in Women that ſeldom accompany with a Man, and that have never born Children, than in thoſe that have born many Children, and in Whores that uſe frequent copulation, or thoſe that have long laboured under the *fluor albus*, for in all theſe three ſorts they are almoſt obliterated.

It has very many Arteries and Veins, ſome of which inoſculate one with another, and others not: By the Arteries that open into it do the *Menſes* ſometimes flow in Women with Child that are plethorick: for they cannot come from the Womb it ſelf, unleſs abortion follow, as ſometimes it does. Theſe Veſſels bring plenty of B'oud hither in the venereal congreſs, which heating and puffing up the *Vagina* encreaſeth the pleaſure, and hinders the Man's Seed from cooling before it reach the *Uterus*. They ſpring not only from the Hypogaſtrick but alſo from the Hemorrhoidal, but theſe latter run only through the lower part of the *Vagina*. Its Nerves ſpring from thoſe that are inſerted into the *Uterus*, but moſt from thoſe of *Os ſacrum*. *De Graef* ſays that all along the *Vagina* there are abundance of pores, out of which a ſerous pituitous humour always flows to moiſten it, but eſpecially *in coitu*, when it is ſometimes offenſive to the Man through its quantity, but encreaſes the pleaſure of the Woman, and is that which is taken for her Seed, as has been noted already.

Near its outer end, under the *Nympha* (of which in the next Chapter) in its fore and upper part it receives the neck of the Urinary bladder encompassed with its Sphincter; oppoſite
whereto

whereto in its hinder or lower part it is strongly knit to the Sphincter of the streight Gut.

In Virgins its duct is so strait, that at their first congress with a Man they have commonly more pain than pleasure through the extension of it by the *Penis*, whereby some small Vessels break, out of which Blood issues as out of a slain Victim (to speak with *Diemerbroeck*:) unless we should rather think that the Blood proceeds from the rupture of the *Hymen*, which we now come to describe.

Hymen.

The *Hymen* is a thin Nervous membrane interwoven with carnos Fibres, and endowed with many little Arteries and Veins, spread across the duct of the *Vagina*, behind the insertion of the neck of the Bladder, with a hole in the midst that will admit the top of ones little finger, by which the *Menses* flow. It is otherwise called the Zone or Girdle of Chastity. Where it is found in this form described, it is a certain note of Virginity; but upon the first admission of a Man's Yard it is necessarily broke and bleeds, which Blood is called the *Flower of Virginity*; and of this the holy Text makes mention in *Deuteron. 22. verses 13.---21.* And when once it is broke, it never closes again.

But though a Bridegroom when he finds these signs of Virginity may certainly conclude he has married a Maid; yet it will not follow on the contrary, that where they are wanting, Virginity is also wanting. For the *Hymen* may be corroded by acrimonious fretting humours flowing through it with the *Menses*, or from the falling out or inversion of the *Uterus* or the *Vagina* at least,

least, which sometimes happens even to Maids. Or if a Maid be so indiscreet as to become a Bride while her Courses flow or within a day after, then both the *Hymen* and the inner wrinkled Membrane of the *Vagina* are so flabby and relaxed, that the *Penis* may enter glibly without any lett, and so give suspicion of Unchastity, when indeed she's unblameable saving for her imprudence to marry at that season.

Sometimes in elderly Maids the *Hymen* grows so strong that a Man is glad to make many essays before he can penetrate it. Yea in some naturally it is quite closed up, and these by this means having their *Menses* stopt, are in great peril of their life if they be not relieved by Surgery, viz. opening it with some sharp Instrument.

Close to the *Hymen* lie the four *Caruncula myrtiliformes*, so called from their resembling Myrtle-berries. The largest of them is uppermost, standing just at the mouth of the urinary passage which it shuts after water is made. Opposite to this in the bottom of the *Vagina* there is another, and on each side one, so that they stand in a square. But of these there is only the first in Maids; the other three are not indeed Caruncles, but little knobs made of the angular parts of the broken *Hymen* roll'd into a heap by the wrinkling of the *Vagina*, according to *Riolanus* and *Diemerbroeck*. These three when the *Vagina* is extended in a Woman's labour, lose their asperity and become smooth, so that they disappear, untill it be again contracted to its natural straitness.

Carunculae myrtiliformes.

De Graef affirms, "that the *Vagina* near its outer orifice has a Sphincter muscle almost
"three

“three fingers broad, that upon occasion con-
 “strings or contracts it. So that he says Men
 “and Women need not be solicitous concerning
 “the Genitals being proportionable one to the
 “other; for the *Vagina* is made so artificially
 “(*affabrè* is his word) that it can accommodate
 “it self to any *Penis*, so that it will give way to
 “a long one, meet a short one, widen to a thick
 “one, constringe to a small one : so that every
 “Man might well enough lie with any Woman,
 “and every Woman with any Man.] Thus he.

Having thus described the parts of the *Vagina*,
 its use is easily declared to be, to receive the Man's
 Yard being erect, to direct and convey the Seed
 into the Womb, to serve for a Conduit by which
 the *Menses* may flow out, and to afford a passage
 to the *Fœtus* in its birth, and to the After-
 birth.

CHAP. XXIX.

*Of the Pudendum muliebre , or Woman's
 Privy.*

THE parts that offer themselves to view
 without any diduction are the *Fissura magna*
 or great chink, with its *Labia* or Lips, the *Mons
 Veneris* and the Hairs. These parts are called by
 the general name of *Pudenda*, because when they
 are bared they bring *pudor* or shame upon a
 Woman.

The

The great Chink is called *Cunnius* by *Galen*, & *Fissura*. *Uterus* to conceive; by *Hippocrates*, *Natura*. It is also called *Vulva*, *Porcus*, *Concha*, and by many other names that fancy has imposed upon it.

It reaches from the lower part of *Os pubis* to within an inch of the *Anus*: being by Nature made so large, because the outward Skin is not so apt to be extended in travail as the membranous *Vagina* and *Collum minus* are. It is less and closer in Maids than in those that have born Children. It has two Lips, which towards the *Pubes* grow thicker and more full or protuberant, and meeting upon the middle of the *Os pubis* make that rising that is called *Mons veneris*, the Hill of *Venus*, which all those that will war in the Camp of *Venus* must first ascend.

Its outward substance is Skin covered with Hair, as the *Labia* are, which begins to grow here about the fourteenth year of age. The inner substance of this Hill, which makes it bunchy, is most of it fat, and serves for a soft Cushion as it were in copulation to hinder the *Ossa pubis* of the Man and Woman to hit one against the other, for that would be painful and disturb the venereal pleasures. Under this fat lies that Muscle that we spoke of from *de Graef* in the last Chapter, that constricts the orifice of the *Vagina*, and springs from the *Sphincter ani*.

By a little drawing aside the *Labia* there then appear the *Nympha* and the *Clitoris*.

The *Nymphs* are so called because they stand next to the Urine as it spouts out from the Bladder, and keep it from wetting the *Labia*. They are called also *Ala* or Wings. They are placed on

on each side next within the *Labia*, and are two carnous and soft productions, beginning at the jointing of the *Ossa pubis* or upper part of the Privy (where they are joined in an acute angle, and make that wrinkled membranous production that clothes the *Clitoris* like a *Præputium* or Foreskin) and descending, close all the way to each other, reaching but about half the breadth of the orifice of the *Vagina* and ending each in an obtuse angle. They are almost triangular, and therefore, as also for their colour, are compared to the thrills that hang under a Cock's throat.

Their substance.

They have a red substance, partly fleshy, partly membranous; within soft and spongy, loosely composed of small Membranes and Vessels, so that they are very apt to be distended by the influx of the Animal spirits and Arterial blood. The Spirits they have from the same Nerves that run through the *Vagina*, and Blood from that branch of the inner Iliacal artery that is called *Pudenda*: Veins they have also from the *Vena pudenda* which carry away the Arterial blood from them when they become flaccid. They are larger in grown Maids than in younger, and larger yet in those that have used Venery or born Children. They never according to nature reach above half way out from between the *Labia*.

Use.

Their use is to defend the inner parts, to cover the urinary passage, and a good part of the orifice of the *Vagina*. And to the same purposes serve the *Labia* above described.

Clitoris.

Above betwixt the *Nympha* in the upper part of the *Pudendum* does a part jet out, a little that is called *Clitoris*, from *κλειτορις*, that signifies lasciviously

viously to grope the *Pudendum*. It is otherwise called *Virga*, for it answers to a Man's Yard in shape, situation, substance, repletion with spirits and erection, and differs from it only in length and bigness. In some it grows to that length as to hang out from betwixt the Lips of the Privy: yea there are many stories of such as have had it so long and big as to be able to accompany with other Women like unto Men, and such are called *Fricatrices*, or otherwise *Hermaphrodites*; who it is not probable are truly of both Sexes, but only the *Testes* fall down into the *Labia*, and this *Clitoris* is preternaturally extended. But in most it jets out so little as that it does not appear but by drawing aside the *Labia*.

It is a little, long and round body, consisting (like a Man's *Penis*) of two nervous and inwardly black and spongy parts, that arise on each side from the bunching of the *Ossis Ischium*, and meet together at the jointing or conjunction of the *Ossa pubis*. It lies under the fat of *Mons Veneris*, in the top of the great fissure. In Venery by means of the two nervous bodies it puffs up, and straitening the orifice of the *Vagina* contributes to the embracing of the *Penis* the more closely.

Its outer end is like to the *Glans* of a Man's *Glans*. Yard, and has the same name, as also *Tentigo*. And as the *Glans* in Men is the seat of the greatest pleasure in copulation, so is this in Women: whence it is called *Amoris dulcedo* and *asfrum Veneris*. It has some resemblance of a *Foramen*, but it is not pervious. It is most of it covered with a thin Membrane from the conjunction of the *Nympha*, which for its likeness to the *Præputium* in Men is also called so.

The

Muscles.

The *Clitoris* has two pair of Muscles belonging to it. The upper are round and spring from the Bones of the *Coxendix*, and passing along the two nervous bodies above-described are inserted into them. These by straitning the roots of the said bodies do detain the Bloud and Spirits in them, and so erect the *Clitoris*, even as those in Men do the *Penis*. The other arise from the *Sphincter ani*, and are those we mention'd above in the end of the foregoing Chapter: for though they have been thought to serve for the erection of the *Clitoris*, yet we think with *deGraef* that they rather contribute to the pursing up or constringing the outer orifice of the *Vagina*.

Vessels.

It has Veins and Arteries from the *Pudenda*, and Nerves from the same origine with the *Vagina*, which are pretty large.

Its use may be known from what has already been discoursed. And we will note further, that in some Eastern Countries it uses to be so large, that for its deformity and the hindrance it gives to copulation, they use to cut it quite out, or hinder its growth by searing it, which they improperly call Circumcision.

The Explanation of the Table.

Figure I.

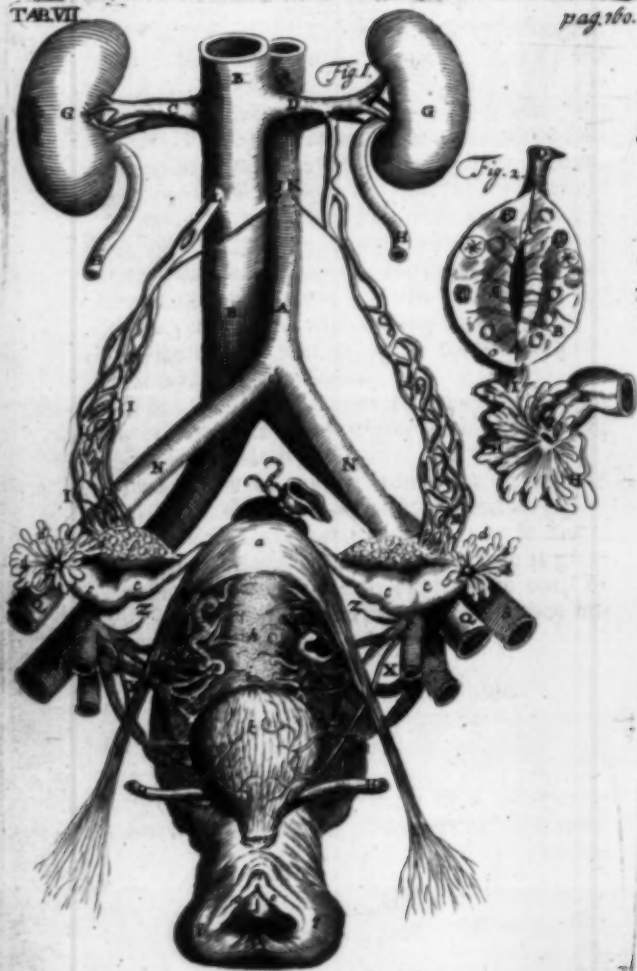
Representeth the Genital parts of a Woman taken out of the Body, and placed in their natural situation.

AA The trunk of the great Artery.

BB The trunk of the Vena cava.

C The





- C *The right Emulgent vein.*
- D *The left Emulgent vein.*
- E *The right Emulgent artery.*
- F *The left Emulgent artery.*
- GG *The Kidneys.*
- HHHH *The Ureters cut off.*
- I *The right Spermatick artery.*
- K *The left Spermatick artery.*
- L *The right Spermatick vein.*
- M *The left Spermatick vein.*
- NN *The Iliack arteries.*
- OO *The Iliack veins.*
- PP *The inner branches of the Iliack artery.*
- QQ *The outer branches of the Iliack artery.*
- RR *The inner branches of the Iliack vein.*
- SS *The outer branches of the Iliack vein.*
- TT *The Hypogastrick arteries carried to the Womb
and Vagina.*
- UU *The Hypogastrick veins accompanying the said
arteries.*
- XX *The branches of the Hypogastrick artery tend-
ing to the urinary Bladder.*
- YY *The branches of the Hypogastrick vein carried to
the Bladder.*
- ZZ *Portions of the Umbilical arteries.*
- a *The Fundus uteri cloathed with its common Coat.*
- bb *The round Ligaments of the Womb as they are
joyned to its Fundus.*
- cc *The Tubæ Fallopiæ in their natural situation.*
- ddd *The Fimbriæ or jags of the Tubæ*
- ee *The Foramina or hollows of the Tubæ.*
- ff *The Testicles in their natural situation.*
- g *A portion of the streight Gut.*
- h *The neck of the Womb, divested of its common
Coat, that the Vessels may be better seen.*

- i *The fore-part of the Vagina of the Womb, freed from the urinary Bladder.*
- k *The urinary Bladder contracted.*
- ll *The Bloud-vessels running through the Bladder.*
- m *The Sphincter muscle constringing the neck of the Bladder.*
- n *The Clitoris.*
- oo *The Nymphæ.*
- p *The urinary passage.*
- qq *The Lips of the Pudendum.*
- r *The orifice of the Vagina.*

Figure II.

Exhibiteth a Woman's Testicle or Ovarium with the end of the Tuba annexed to it.

- A *The Testicle opened lengthways in its lower part.*
- BB *Eggs of divers bigness contained in the membranous substance of the Testes.*
- CC *The Bloud-vessels in the middle of the Testes, proceeding plentifully from its upper part, as they run to the Eggs.*
- DD *The Ligament of the Testicles, whereby they are knit to the Womb, cut off.*
- EE *A part of the Tuba Fallopiana cut off.*
- F *The Cavity of the Tuba cut off.*
- GG *The hole that is in the end of the Tubæ.*
- H *The leavy ornament of the Tubæ.*
- I *The leavy ornament of the Tubæ knit to the Testes.*

CHAP. XXX.

Of a Conception.

HAVING described all the parts that serve for Generation both in Man and Woman ; order would, that we should speak of the efficient causes, matter or principles from whence that which is generated by and in them, doth proceed. And in the first place there occurs the Man's Seed, which is the *active* principle or efficient cause of the *Fœtus* ; but when we discoursed of the *Testes*, we shewed what the matter of it was, *viz.* Arterial blood and Animal spirits ; and as to the manner of its fecundating the *Ovum*, we omit that as being too philosophical for this place. In the next place therefore we must come to the matter or *passive* principle of the *Fœtus*, and this is an *Ovum* impregnated by the Man's Seed. And here because in Women it cannot be observed by what degrees and in what time an *Ovum* in the *Ovarium* or *Testis* becomes a Conception in the *Uterum*, we must be forced to guess at that by the analogy in other Creatures. To this purpose Dr. Harvey *de generatione Animalium* is worthy to be read of the curious ; especially concerning the manner and order of the generation of the parts of a Chicken in an Hens Egg, in his *Exercit.* 56. But when he comes to apply this to the Conceptions of viviparous Animals, being ignorant that there was any formal *Ovum* pre-existing in them, and only then fecundated, he runs into great errors and odd notions about Conception: imagining

gining an analogy betwixt the Brain's forming its Phantasms or Conceptions, (which he calls Animal) and the Wombs forming hers, which he calls Natural. He rightly indeed rejects the Hypothesis of the Womans having true Seed, as also the notion that the Man's Seed is any part of the Conception : but then he gives an unsatisfactory account of it when he says it is formed of the primeval albugineous humours that transude into the *Cornua* in Brutes or *Uterus* in Women, after they are impregnated or matur'd, as he speaks. I shall not therefore rehearse the history of generation in Harts that he has given us, for an analogical explication of that in Women ; but shall transcribe the observations of the curious *de Graef* concerning the generation of Rabbits, as being more adapted to our purpose.

" We made the first trial, (says he) on a female Rabbet that had not yet accompanied with the male. Dissecting which we observed a very wide *Vagina* and about eight fingers breadth long, which being opened lengthways, there stood out two narrow mouths in its upper part divided with a semilunar partition, namely the beginning of each *Cornu* : for the Womb in Conies is presently from the very *Vagina* divided into two parts, one of which bends towards the right hand, the other towards the left about three fingers breadth asunder, where they are presently contracted and continued with the Oviducts, which in these Animals have a peculiar situation (or make) because if you lightly blow up the *Cornua* these will not swell, nor the wind penetrate them because of some loose *Fimbria* or rags closing like the valve
" of

“ of the Gut Colon. These Oviducts being small
 “ at their rising from the *Cornua*, for five fingers
 “ breadth run with a winding duct beyond the
 “ Testicles, widening more and more by degrees,
 “ and then they turn back towards them and end
 “ in the form of a Tunnel The Testicles are
 “ small, but contain very many limpid Eggs,
 “ which being cut open there issued out a clammy
 “ liquor like the white of an Egg. This being
 “ premised,

“ We opened another half an hour after the
 “ *coitus*, the *Cornua* of whose *Uterus* lookt a little
 “ redder, but the *Ova* in the Testicles were not
 “ yet chang’d, unless they had remitted a little
 “ of their clearness: but neither in the *Vagina*
 “ nor in the *Cornua* could we perceive any Seed or
 “ any thing like it.

“ About six hours after the coupling we dissec-
 “ ted another, in whose Testicles the *Folliculi* (or
 “ Cases) of the *Ova* inclined to redness, out of
 “ which being pricked with a needle a clammy and
 “ clear liquor issued first, but blood followed,
 “ flowing out of the Sanguinary vessels dispersed
 “ through the *Folliculi*: We could find no Seed
 “ neither in this Coney.

“ Four and twenty hours after the *coitus* we
 “ opened another, in one of whose Testicles we
 “ found three, and in the other five *Folliculi* of
 “ the *Ova* very much changed; for being before
 “ limpid and colourless, they were now turn’d
 “ dusky and of a faint red, in the middle of
 “ whose superficies a little *Papilla* (or Teat)
 “ as it were discover’d it self: when the *Folli-*
 “ *culi* were cut open, there appear’d a little
 “ limpid liquor in their middle, and in their

“circumference a certain thicker and reddish matter.

“Twenty seven hours after the *coitus* we inspected another, the *Cornua* of whose *Uterus* with the Oviducts looked more bloody, also the extremity of the Oviduct did on every side embrace the *Testes* like a Tunnel; in the middle superficies of the *Folliculi*, as in those before, there stood out little *Papilla*, through which by pressing the substance of the Testicles there issued a limpid liquor, which was followed by another redder and thicker. Opening the *Cornua* of the Womb we found no Eggs, but the inner wrinkled tunicle of the *Cornua* was a little more tumid.

“Eight and forty hours after the *coitus* we examin'd another, in one of whose Testicles we found seven, in the other three *Folliculi* changed, in whose middle the *Papilla* were something more eminent, through which, by pressing the substance of the Testicles, there issued a little liquor like the white of an Egg, but the remaining reddish substance of the *Ova*, being now become something thicker, was not so easily pressed forth as in those before.

“Two and fifty hours after the *coitus* we viewed another, in one of whose Testicles we found one, in the other four *Folliculi* altered; cutting open which we found a glandulous-like matter, in the middle of which there was a little Cavity, wherein finding no notable liquor, we begun to suspect whether or no their limpid substance, which is contained in proper Membranes, were burst forth or expelled: wherefore we searched carefully both the Oviducts and the *Cornua*, but

“we
“we

"we could find nothing; only the inner tunicle
"of the *Cornua* being much pufft up shined.

"Seventy two hours (or three days and
"nights) after the *coitus* we inspected another,
"which exhibited a far other and most wonder-
"full change; for the *Infundibulum* did embrace
"the Testicles on every side most closely, which
"being pull'd off we found in the Testicle of the
"right side three *Folliculi* a little greater and
"harder, in the middle of whose superficies we
"saw a tubercle with a little hole in it like a *Pa-*
"pilla; but dissecting the said Cases through the
"middle, their Cavity was quite empty; where-
"fore we searched the ways through which the
"*Ova* must pass, again and again, and found in
"the middle of the right Oviduct one, and in
"the outer end of the *Cornu* of the same side two
"very small Eggs, little bigger than small pins
"heads, which notwithstanding their smallness
"are cloathed with a double Coat; out of these
"Eggs being pricked there issued a most limpid
"liquor. In the very beginning of the
"*Cornu* of the left side we found only one Egg,
"just like those small ones of the other side:
"whence it is clear that the *Ova* excluded out of
"the *Testes* are ten times less than those that yet
"stick in the *Testes*; which seems to us to come
"to pass inasmuch as those that are still in the
"*Testes* contain as yet another matter, namely
"that of which the glandulous substance of the
"Cases is made.

"The fourth day from the *coitus* we opened a-
"nother, in one of whose Testicles we found
"four, in the other three Globules or Cases emp-
"tied; and in the *Cornua* of the respective sides

" we found as many Eggs, greater than the former, which did not stick in the Oviducts or beginnings of the *Cornua*, but were now rolled on towards their middle: in their Cavity we beheld as it were another Egg swimming, far clearer than in the other before.

" The fifth day from the *coitus* we dissected another, in whose *Ovaria* or Testicles we told six emptied *Folliculi*, that had each a notable *Papilla*, through whose Foramen we easily put an ordinary bristle into their Cavity: we found also the same number of Eggs (bigger than those the day before) in divers parts of the *Cornua*, in which they lay so loosely, that by blowing only, one might drive them this way or that way: The inner tunicle of these (or the Egg within an Egg as it were) was become yet more conspicuous.

" The sixth day after the *coitus* we examin'd another, in one of whose Testicles we observ'd six Cases emptied, and in the *Cornu* of the same side we could light of but only five Eggs near the *Vagina*, brought as it were upon a heap: but in the Testicle of the other side we found four *Folliculi* emptied, and in the *Cornu* of that side only one Egg: The cause of which difference we suppose to be, either because some Eggs by the wave-like motion of the *Cornua* (not unlike the peristaltick motion of the Guts) being carried downwards towards the *Vagina* were driven forth; or because being consumed in the *Folliculi* they came not to the *Uterum*; or light on some other mischance. These Eggs were as big as small Pease:

" The seventh day from the *coitus* we examin'd another,

“another, in whose *Ovaria* we found some *Folliculi* emptied that were greater, redder and
 “harder than the foregoing, and saw as many
 “transparent Tumours or Cells in divers parts of
 “the *Uterus*; out of which being opened we turned
 “*Ova* as big as Pocket-pistol Bullets, in
 “which we beheld nothing but the Inner tunicle
 “very conspicuous and a most limpid humour.
 “It is to be wondred at, that in so short a space
 “of time the Eggs should imbibe so great plenty
 “of liquor, that whereas before they might easily
 “be taken out of the Womb, now they could
 “very difficultly.

“The eighth day from the *Coitus* we opened
 “another, in the right *Cornu* of whose *Uterus*
 “we saw one, in the left two Cells; one of these
 “was almost twice as big as the other: for Nature
 “doth sometimes so vary, that there are Eggs of
 “divers bigness found not only in divers Animals
 “of the same species dissected at the same distance
 “from the *coitus*, but also in one and the same Individual.
 “In the horns of the Womb being opened we saw the Eggs a little bigger than the
 “day before, but all of them, their tunicles
 “breaking, poured out their clear liquor before
 “we could take them quite out: for which reason
 “we tried another dissected likewise the
 “eighth day after the *coitus*; the right *Cornu* of
 “whose *Uterus* we saw swelled up into two, and
 “the left into four transparent Tumours or Cells,
 “out of which that we might take the *Ova* we
 “used the greatest diligence and attention; but
 “as soon as we came to them, their tunicles were
 “so very tender that they burst as the former:
 “which when we saw, the Eggs that remained
 “we

"we boiled with the *Uterus*, whereby their con-
 "tents harden'd like the whites of Hens Eggs.
 "The inner substance of the Cells, on that side
 "whereon it receives the Hypogastrick vessels,
 "was become more tumid and red.

"The ninth day after the *coitus* we dissected a-
 "nother that was old; the Testicles of this were
 "almost as big again as those of younger: in the
 "right we saw two, in the left five *Folliculi* lately
 "emptied, and besides these, others that lookt
 "very pale, which we judged to be those that had
 "been emptied the *coitus* before this, although
 "for the most part they leave only some palish
 "points or specks, to which the increase of the
 "Testicles is owing. The *Folliculi* of the last
 "*coitus* were each beset with a *Papilla*, but the
 "others were smooth. In the right *Cornu* there
 "were two, and in the left five Cells, whose sub-
 "stance being more rare and pellucid than the
 "other parts of the *Uterus* was interwoven with
 "many twigs of Veins and Arteries. Opening
 "some of these Cells, we could see the *Ova*, but
 "could not take them out whole; wherefore be-
 "ing compelled to examine the content of the
 "Eggs in the very hollow of the Cells, we found
 "it clear like Crystal; in the middle whereof a
 "certain rare and thin cloud was seen to swim,
 "which in other Conies dissected likewise on the
 "ninth day after the *coitus* for its exceeding fine-
 "ness escaped our sight. The inner substance of
 "the Cells, namely that which receives the Hy-
 "pogastrick vessels, being more tumid than the
 "rest, exhibited the rudiments of the *Pla-*
 "*centa*.

"The tenth day after the *coitus* we inspected
 "another,

“another, in whose right Testicle we found one
 “only *Folliculus* emptied, which by reason of
 “the Sanguineous vessels dispersed plentifully
 “through it was redder and had a less *Papilla*;
 “in the middle of this pale substance there ap-
 “pear’d as yet a very small Cavity: but in the
 “left Testicle we found six such *Folliculi*. In the
 “*Cornua* of the *Uterus* we found also so many
 “Cells, namely one in the right and six in the left
 “distant a fingers breadth one from another, in
 “the middle of which Cells lay a rude mucilagi-
 “nous draught of the *Embryo* like a little Worm.
 “one might also plainly discern the *Placenta* to
 “which the Egg by means of its *Chorion* was an-
 “nexed. The matter of the Eggs boil’d with
 “the Womb hardned like the white of an Egg,
 “and tasted like the boiled congealed substance of
 “the Eggs in the Testicles.

“The twelfth day after the *coitus* we opened
 “another, in one of whose Testicles we found se-
 “ven, in the other five *Folliculi* emptied, and as
 “many Cells in the *Cornua* much bigger and
 “rounder than the foregoing, in the middle of
 “which the *Embryo* was so conspicuous, that one
 “might in a sort discern its Limbs, in the region
 “of whose Breast two sanguineous specks and as
 “many white ones did offer themselves to view:
 “in the *Abdomen* there grew a certain mucilagi-
 “nous substance inclining here and there to red.
 “We could not discern more in this shapeless lit-
 “tle Animal because of its tenderness.

“The fourteenth day after the *coitus* we dissec-
 “ted another, the Cells of whose *Uterus* we be-
 “held to be yet greater, and the Sanguineous
 “vessels more, and more turgid: we also noted
 “that

" that the Cells the larger they grew, came also
 " nearer to one another, and their Interstices
 " were lessened. The Membranes *Amnios* and
 " *Chorion* were knit together, which though they
 " appear thicker and stronger, are yet more hard
 " to be separated from one another than in the
 " *Ova* taken intirely out of the Womb; tearing
 " these we saw an *Embryo* with a great and pellu-
 " cid Head, with the *Cerebellum* copped; its
 " goggle Eyes, gaping Mouth, and in some sort
 " its little Ears might be discovered also. Its
 " Back-bone was drawn out, of a white colour,
 " which bending in about the *Sternum* resembled
 " a Ship; by whose sides most slender Vessels run,
 " whose ramifications were extended to the Back
 " and Feet. In the region of the Breast two san-
 " guineous specks greater than the foregoing ex-
 " hibited the rudiments of the ventricles of the
 " Heart; at the sides whereof were seen two
 " whitish specks for Lungs. In the *Abdomen* be-
 " ing opened, there first shew'd it self a reddish
 " Liver; then a white Body, to which was knit
 " a mucilaginous matter like a writhed thread,
 " being the rudiments of the Stomach and Guts.
 " All which in those that we dissected afterwards
 " had acquired only a greater bulk and perfection.
 " And therefore to prevent tediousness by re-
 " peating the same things, we will on purpose
 " pass by all the other dissections we made in this
 " kind of Creature, excepting only one which we
 " made the day before the kindling; that those
 " things that in the former were only confusedly
 " discerned, may appear plain in this.

" At length on the twenty ninth day after the
 " coitus we inspected another, that had kindled
 " six

“ six weeks before, and in the *coitus* by which she
 “ was impregnated had voided all the thicker
 “ part of the Seed of the Male, which in some
 “ measure did resemble the consistence of a most
 “ limpid jelly. In her *Ovaria* we found eleven
 “ little whitish *Folliculi*; and besides these, others
 “ far less, little or nothing differing from the
 “ substance of the *Testes*. The *Folliculi* of the
 “ *Ova* in the *Testes* seem not to vanish wholly,
 “ but to leave a certain speck in them; whence it
 “ certainly comes to pass, that Conies, the oft-
 “ ner or the more young ones they bring forth,
 “ have the greater and whiter Testicles; so that
 “ one may guess by only viewing the *Testes*, whe-
 “ ther they have had many young ones or often.
 “ Having view’d the *Ovarium* we past to the *Ute-*
 “ *rus*, which we found no longer distinguish’d in-
 “ to Cells, but all along distended like a Pud-
 “ ding; which was so agitated with a wave-like
 “ motion like the peristaltick of the Guts, that
 “ the young ones nearest the *Vagina* as yet inclu-
 “ ded in their Membranes were excluded, and
 “ that so hastily, that if we had not cut out the
 “ whole *Uterus*, they had all certainly gone the
 “ same way. The Womb was no thicker than
 “ when they are not with young, otherwise than
 “ we have said it to be in Women. In its Cavity
 “ we saw eleven *Fetus* sprawling, which were all
 “ so closely coupled together by the Membrane
 “ *Chorion* (wherein all are severally involved)
 “ as if they had all been included in one and the
 “ same *Chorion* ———.

Thus much I thought fit to translate of that ac-
 curate Anatomists observations concerning the
 generation of this sort of Animal, because it
 gives

gives so very great light into the manner of the generation of a humane *Fetus*. For there is an exact analogy betwixt them, abating some circumstances; as *First* that in Women the Conception is not formed in the *Cornua*, seeing her Womb has none, nor in the *Tuba* very seldom and according to Nature, for they are only the *Infundibula* or Oviducts to convey the *Ova* from the *Testes* to the *Fundus uteri*, though they bear some resemblance to the *Cornua* in Brutes; I say the Conception is not formed in these, but in the *Fundus uteri* or Womb properly so called, where-into the *Ovum* being received presently begins to swell and grow bigger, and there appears as it were an Egg within an Egg, by means of the two Membranes with which it is cloathed; which Membranes are originally in the *Ovum* while it is in the Testicle, and imbibe the moisture that is sent now plentifully into the Womb, even as the little Yelks in Hens, &c. gather the white about them in the Oviduct and *Uterus*, which they have none of in the *Ovarium*; or as Seeds in the Ground do imbibe the fertile moisture thereof to enable them to sprout. Another considerable circumstance wherein they differ is the slow procedure of the formation of the *Fetus* in Women in comparison of that in Conies now described. For seeing these go with young but 29 or 30 days, and Women nine months, we must imagine that the *Embryo* is as perfectly formed in the former on the tenth day as in the latter in the tenth week, or longer. But I say abating these or if there be any other such like circumstances, there is so great a likeness betwixt the one and other, that without insisting more on the matter or manner of the

Conception, we shall pass on to the description of the parts that encompass the *Fœtus*, then shew how it is nourished, and lastly what parts there are in a *Fœtus* that differ from those in a Child born.

CHAP. XXXI.

Of the Placenta Uterina or Womb liver, and Acetabula.

IN dissecting the Womb of a Woman with Child the first thing that offers it self is the *Placenta uterina* or Womb-cake, otherwise called *Hepar uterinum* or Womb-liver, from the likeness of substance, and also use according to those that imposed the name.

Its substance is very like that of the Spleen, *its substance.* only that is more brittle and this more tenacious, so that it cannot so easily be separated from the Vessels. It is soft and has innumerable Fibres and small Vessels. Its *Parenchyma* is partly glandulous, by means of which Glands the separation of humour that is made in it, is performed.

It is of very different shapes in several Creatures, but in Women it is circular, yet with some *Shape and situation.* inequalities in its circumference. It is two fingers breadth thick in its middle (but thinner near the edges) and a span or a quarter of a yard over from one side to the other when the *Fœtus* is come to maturity ready for the birth. On that side next the *Fœtus* it is smooth and something hollowish like Navel-wort, and is knit to the *Chorion*;

Chorion; but on that next the Womb it is very unequal, having a great many tubercles or bunnings whereby it adheres fast and immediately to the Womb. But to what part of it, is not agreed among Anatomists, some affirming it to grow to the fore-part, some to the hinder-part; some to the left side, others to the right. Dr. *Wharton* (assenting to *Fallopins*) says, it always adheres to one of the two corners of the Womb (that answer in some manner to the *Cornua* in Brutes) whereinto the *Foramen* of the *Tuba* opens; so that he says the said *Foramen* is as it were the centre to the *Placenta*. *De Graef* thinks it is most commonly fasten'd there, but not always, because the *Ovum* for a while being loose in the Cavity of the *Uterus*, may be tumbled to this or the other part, and wherever it fixes, there is it join'd to the Womb by the *Placenta*.

Number.

When there is but one *Fœtus* in the Womb it is but one, but if there be Twins, then according to Dr. *Wharton*, &c. are there two *Placenta*, either distinct in shape, or if they appear in the shape of one, then are they separated by a Membrane one from the other; and a particular rope of Umbilical vessels, is inserted into each from each *Fœtus*.

Origine.

It grows not out of the Womb originally, but its first rudiments appear like a woolly substance on the outside of the outer Membrane that invests the *Embryo* (called *Chorion*) about the eighth or ninth week, upon which in a short while a red, carnous and soft substance grows, but unequally and in little knobs, and then it presently thereby sticks to the Womb, and is very conspicuous about the twelfth or thirteenth week. Till now the

the *Fœtus* is encreased and nourished wholly by the apposition of the crystalline or albugineous liquor wherein it swims loose in the inner Membrane (called *Amnios*) having no *Vasa umbilicalia* formed, by which to receive any thing from the *Placenta*. But when it waxes bigger and begins to need more nourishment, the extremities of the Umbilical vessels begin to grow out of the Navel by little and little, and are extended towards this *Placenta*, that out of it, as Plants by their Roots out of the Earth, they may draw a more firm nutritive juice, and carry it to the *Fœtus*. But of this more in the 33^d Chapter.

It has Vessels from a double origine, some from *Vessels* the Womb, and some from the *Chorion*. The former are of four kinds, Arteries, Veins, Nerves and Lympheducts: all which though they be very large and conspicuous in the Womb, and are so even in that very place where the *Placenta* is joined to it; yet they send but the smallest Capillaries into the *Placenta* it self (namely that half that is next the Womb.) Those that come from the *Chorion* are Arteries and Veins, and Dr. *Wharton* supposes also Lympheducts. The Arteries and Veins that come from the Womb spring from the Hypogastricks, and also that branch of the Spermaticks that is inserted into the bottom of the Womb. Those that come from the *Chorion* are the Umbilical vessels of the *Fœtus*. Of the use of both the one and other we shall speak in Chap. 33. when we come to discourse how the *Fœtus* is nourished, as also of the use of the *Placenta* it self, of which we shall only observe this further here, That after it is joined to the Womb, it sticks most firmly to it for the first months, as unripe

Fruit do to the Tree: But as the *Fetus* becomes bigger, and riper and nearer to the birth, by so much the more easily will it part from the Womb, and at length, like to ripe Fruit, after the Child is born, it falls out of the Womb and makes part of the After-birth.

Acetabula.

It was an old tradition continued for many hundred years, that the *Placenta* adheres to the Womb by certain parts called *Coryledones* or *Acetabula*. That there are such in some Creatures it is certain; Dr. *Needham* says they are only properly so called in Sheep and Goats, in whom being with young the Uterine glands are hollow like a Saucer or an Acorn-cup, and are adapted to the little Prominences (or *Digituli*) of the *Placentula* that grow on the *Chorion*; (though *Diemerbroeck* say, that on the contrary the *Placentula* are hollow (and so are truly the *Acetabula*) and the Uterine glands protuberant) and doubts not but these names were first given by those that dissected these kind of Creatures, and were afterwards applied in following ages to other Animals. So that no wonder there have been so great contests even about the signification of the word *Coryledon* (which is the Greek word for the herb *Umbilicus Veneris* or Navelwort) and what that was that was so called in the several Creatures that were said to have them. But because such Controversies are now obsolete, and that 'tis generally confessed that Women have them not, we shall not in this Epitome run out into needless Disputes; but only observe one singular opinion of *Diemerbroeck*, who ascribes *Coryledones* to Women. He thinks that each Woman (unless she go with Twins) has but one
Coryledon,

Coryledon, and that the foresaid *Placenta uterina* is it. And indeed it must be confest that it resembles much the shape of that from which the *Coryledones* have their name; and therefore seeing he formed this opinion to defend our great Master *Hippocrates*, who had ascribed them to Women, (that is, as *Diemerbroeck* expounds it, one *Coryledon* to one Woman) we shall not oppose it, but confess it to be, if not true, yet both ingenious and ingenuous.

CHAP. XXXII.

Of the Membranes involving the Fœtus, and of the humours contained in them.

NEXT to the *Placenta* follow the two Membranes that involve the whole *Fœtus*, *Chorion* the outer, and *Amnios* the inner: betwixt which two, after the *Fœtus* is perfectly formed, *Dr. Needham*, &c. affirms there is a third, viz. *Allantois*, which in Women likewise includes the whole *Fœtus*. Of each of these in their order, with the liquors they contain.

The outmost Membrane is called *Chorion*, it is pretty thick, smooth on the inside, but without something unequal or rough, and in that part of it that adheres to the *Placenta* and by it to the Womb, has very many Vessels which spring from the *Placenta* it self and the Umbilical vessels. It is but one even when the Mother goes with Twins: for as in a Nut that has two Kernels in it, they are both included within the same Shell, but

N 2

are

are each invested in their proper Membrane ; so Twins are both inclosed in one *Chorion*, but have each a particular *Amnios*. It invests the *Ovum* originally, which *Ovum* being brought into the Womb and becoming a Conception, this Membrane imbibes the moisture that bedews the Womb plentifully at that time. For whiles the Conception is loose in the Womb, and has no Vessels that reach out of it self, nor is fasten'd to any part, it must have its increase after the same manner as the Egg has in Hens, " which while it " is in the *racemus* or knot, attains no other substance but Yelk ; and when it drops off from " thence and descends through the *Infundibulum*, " it receives no alteration ; but when it comes " into the Cells of the process of the *Uterus*, it " begins to gather a White, although it stick to " no part of the *Uterus* nor has any Umbilical " Vessel ; but (says my Author, the immortal " * *Harvey*) as the Eggs of Fishes and Frogs do " without, procure to themselves Whites out of " the water ; or as Beans, Pease and other pulse, " and Bread-corn being steep'd in moisture swell, " and thence acquire aliment for the bud that is " springing out of them : so in like-manner out " of the *plica* or wrinkles of the Womb (as out " of a Dug or Womb-cake) does there an albuminous moisture flow, whence the Yelk (by " that vegetative and innate heat, and faculty " wherewith it is endued) gathers and concocts its " White. And therefore in those *Plica* and the " hollow of the Womb does there plentifully abound a liquor resembling the taste of the White. " And thus the Yelk descending by little and little " is encompassed with a White, till at last in the " outmost

* De generat. Animal. Exercit. 9. de generat. Ovi.

"outmost *Uterus* having assumed Membranes and
 "a Shell, it is perfected] Thus I say does the
Chorion imbibe that albugineous liquor that from
 the first Conception increases daily in it (and
 transfuses through the *Amnios* wherein the *Embryo*
 swims) till the Umbilical vessels and the *Placenta*
 are formed, from and through which the *Fœtus*
 may receive nourishment.

This liquor that it imbibes I take to be nutriti- *Its liquor.*
 ous juice that ouzes out of the capillary orifices of
 the Hypogastrick and Spermatick arteries, and is
 of the same nature with that which afterwards is
 separated in the *Placenta* and carried to the *Fœtus*
 by the Umbilical vein, and with that also which
 abounds in the *Amnios* even till the birth. For
 the plastick or vegetative virtue is only in the
Ovum it self, and the augmentation that the first
 lineaments of the *Embryo* receive, is only by ap-
 position of this nutritious albugineous juice. But
 this Membrane *Chorion* by that time the Umbili-
 cal Vessels and *Placenta* are formed, is grown so
 dense and compact, that it is not capable of im-
 bibing more; but that which at this time is in it,
 does in small time transfuse into the *Amnios*, and
 so it self becomes empty, and gives way to the
 encrease of the *Allantois*, (which thenceforward
 begins to appear) whose liquor augments daily
 as the *Fœtus* grows nearer and nearer to the birth.
 This is my conjecture, which I submit to the cen-
 sure of the learned.

The *Amnios* is the inmost Membrane that im- *Amnios.*
 mediately contains the *Fœtus*. It is not knit to
 the *Chorion* in any place save where the Umbili-
 cal vessels pass through them both into the *Pla-*
centa. It is very thin, soft, smooth and pellucid,

and encompasses the *Fœtus* very loosely. It has Vessels from the same origins as the *Chorion*. It is something of an oval shape.

Its liquor.

Before the *Ovum* be impregnated, this Membrane contains a limpid liquor, which after the impregnation is that out of which the *Embryo* is formed. In it resides the plastick power and the matter also out of which the first lineaments of the *Embryo* are drawn. But because its liquor is so very little, there transudes through this Membrane presently part of that nutritious albugineous humour that is contained in the *Chorion*, which it had imbibed out of the *Uterus*, as was but even now shewn, and this Dr. *Harvey* calls *Colliquamentum*. And by the juxta-apposition or addition of this humour to the undiscernible rudiments of the *Embryo*, it receives its encrease. But though the *Amnios* have its additional nutritious liquor at first only by transudation; yet when the Umbilical vessels and the *Placenta* are formed, it receives it after another manner. For then being separated from the Mothers Arteries by the *Placenta* and imbibed by the Umbilical veins of the *Fœtus*, it passes directly to its heart, from whence being driven, a great part of it, down the *Aorta*, it is sent forth again by the Umbilical arteries, out of whose capillaries dispersed plentifully through the *Amnios* it issues into its Cavity, even as far more gross and viscid juices in taking a purge (or sometimes critically) ouze out of the small mouths of the Arteries that gape into the Intestins.

There are some that think they have observed *Vena lactea* to come directly to the *Placenta*, and that out of it (as out of the Glands in the Mesentery)

sentery) there arise others that convey the Chyle into the *Amnios*: and this indeed were a plausible opinion, if it were grounded on any certain or frequent observation of such Lacteals, and were not rather invented to avoid some difficulties with which the former opinion seems to be pressed.

A third Membrane which invests the whole *Fœtus* (according to Dr. Needham, &c.) is that ^{Allantoi-} ^{des.} called *Allantoides*, though improperly as to Women. For it is so called from its likeness to a Pudding (*ἀνάσπιστος*, *Farcimen*) which indeed it does resemble in Sheep, Does, Hogs, &c. but in Women, as also in Mares, it has the same figure as the *Chorion* and *Amnios*, betwixt which it is placed in their whole circumference. Now though it must be supposed that this as well as the other two, is originally in the *Ovum*, yet there is no appearance of it till after the Umbilical Vessels and *Placenta* are formed, and the albuminous liquor (so often mentioned) ceases to be imbibed by the *Chorion* out of the *Uterus*. But as soon as the *Fœtus* begins to be nourished by the Umbilical vessels, and the *Urachus* is permeable, then presently this Membrane begins to shew it self, containing a very thin liquor, which is the Urine of the *Fœtus* brought into it by the *Urachus* from its Bladder, and with which it is filled daily more and more till the birth. It is very thin, smooth, soft and yet dense. It may be known from the *Chorion* and *Amnios* by this, that they have numerous Vessels dispersed through them, but this has not the least visible Vein or Artery. It is very hard to separate the *Chorion* from it, because when it appears, the *Chorion* becomes void

of all liquor, and so claps close to it. But towards the birth of the *Fetus* it becomes so turgid with Urine, that the *Amnios* (immediately containing the *Fetus*) swims in it, and so may most easily be distinguished and separated from it.

Its liquor.

The liquor that it contains is (as has been said) the Urine of the *Fetus* brought hither by the *Urachus*. For as soon as the *Fetus* is perfectly formed, its Kidneys must needs perform their office of separating the *Serum* from the Blood, for otherwise it would be affected with an *Anasarca*. I say the *Serum* is separated in the Kidneys and glides down from thence into the Bladder, in which it is found pretty plentiful when the *Fetus* is five or six months old. Now it flows not out of the Bladder by its orifice, because at that time the Sphincter is too contracted and narrow, and if it should pass that way, it would mix with that nutritious juice in which the *Fetus* swims in the *Amnios*, and wherewith, by taking it in by its Mouth, it is partly nourished, and so would defile and corrupt it, and make it unfit for nourishment. Nature therefore has provided it another exit by the *Urachus*, inserted into the bottom of the Bladder; which though after the Child is born it grow solid like a Ligament, like as the *Vena umbilicalis* does, yet while the *Fetus* is in the Womb it is always pervious, and conveys the Urine into the *Allantoides* that is placed betwixt the *Chorion* and *Amnios*, where it is collected and preserved till the birth.

CHAP. XXXIII.

Of the Umbilical vessels, and of the nourishing of the Fœtus.

HAVING opened the Membranes that enwrap the *Fœtus*, there appears the Navel-string ^{The navel-string.} or Rope, which is membranous, wreath'd and unequal, arising out of the middle of the *Abdomen*, (viz. the Navel) and reaching to the Womb-liver or *Placenta*, of a notable length, being three spans or half an Ell long, and as thick as ones finger. It was convenient to be so long and lax, that when the *Fœtus* in the Womb grows strong, it might not break it by its sprawling and tumbling about; and after it is born, the *Secundines* or After-birth might be drawn out the better by it.

The way that it passes from the Navel to the *Placenta* is very unconstant; for sometimes it goes up on the right hand to the Neck, which having encompassed, it descends to the *Placenta*, and sometimes it goes on the left hand up to the Neck, &c. Sometimes it comes not to the Neck at all, but goes first a little up towards its Breast, and then turns round its Back, and from thence passes to the *Placenta*. ^{Its situation.}

The Vessels contained in this string (and ^{Vessels.} which are enwrapped in a common Coat called *Funiculus* or *Intestinulum*) are four, one Vein, two Arteries and the *Urachus*.

The Vein is larger than the Arteries, and arises ^{Vein.}

ses from the Liver of the *Fetus*, (viz. out of its fissure) at the trunk of the *Vena porta* (of which it seems to be but a branch) and from thence passing out of the Navel it runs along the *Funiculus* to the *Placenta*, into which it is implanted by innumerable roots ; but before it reaches it, it sends some little twigs into the *Amnios*.

Its use.

The Ancients that thought the *Fetus* was nourished by the Mothers Bloud only, taught the sole use of this Vein to be, to carry Bloud from the *Placenta* to it : and since it has been found out and believed that it is nourished also (if not only) by Chyle or *Succus nutritius*, some have continued the same office to this Vein, and think that the Chyle is brought by Lacteal vessels arising out of the *Placenta*, as (they say) it was brought thither by the Mothers Lacteals. And indeed if any certain discovery had been made of these same *Lactea*, we should have embraced this opinion as the most probable. But we are not to form hypotheses out of rational notions only, but much rather from what appears to the Eyes of the Dissector. We do affirm therefore that the Umbilical vein serves for conveying to the *Fetus* the nutritious juice separated in the *Placenta* from the Mothers Arteries. How this separation is made, and how it is first of all turned into Bloud, we shall consider by and by.

But together with this juice there returns so much of the Arterial bloud (that comes from the *Fetus*) as is not spent upon the nourishment of the *Placenta*, or of the *Chorion* and *Amnios*.

Besides this Vein which is common to all Creatures, there have been observed in Whelps (and may perhaps in others) two small Veins more
that

that pass directly from the *Umbilicus* to the Mesentery, as the other great one does to the Liver; which may strengthen the opinion that the Chyle or *Succus nutritius* is brought to the *Fœtus* by the Sanguinary vein (or Veins) from the *Placenta*.

In the *Funiculus* are included also two Arteries, *Arteries.* which are not both of them together so big as the Vein. They spring out of the inner Iliac branches of the great Artery, and passing by the sides of the Bladder they rise up to the Navel, out of which they are conducted to the *Placenta* in the same common cover with the Vein and *Urachus*, with which they are twined and wreathed not unlike a Rope. I say they are inserted into the *Placenta*, and with the Vein make a most admirable texture, and net-like *Plexus*. Dr. *Harvey* says, the Vein is conspicuous a pretty while before these Arteries appear.

Blood and Vital spirit are not carried by them *Their use.* from the Mother to the *Fœtus*, as many, from *Galen*, have taught; but on the contrary, Spirituous blood is driven from the *Fœtus*, by the beating of its Heart, to the *Placenta* and the Membranes for their nourishment; from which what Blood remains, circulates back again in the Umbilical vein together with the *Succus nutritius* afresh imbibed by its capillaries dispersed in the *Placenta*. But besides Arterial blood, there flows out of the Navel by them part of the *Succus nutritius* that was imported by the Umbilical vein, namely that of it which is more crass and terrene, which by one circulation through the Heart (or it may be many) could not be changed into Blood: this part I say flows out by these Arteries, which

which by their branches that are dispersed through the *Amnios* disimbogues it by their little Mouths into it; for what use, shall be declared presently.

*How the
vessels pass
through the
mem-
branes.*

And here I shall transcribe a material objection with the answer to it, out of *Diemerbroeck*.
Obj. "How can these Vessels (Vein and Arteries) when they have grown from the belly of the *Fetus* to that length as to reach the Membranes, penetrate and pass through them to the *Placenta*?
Ans. This is done in the same manner as the roots of Herbs, Shrubs and Trees penetrate into the hard Ground, yea often into thick Planks, Walls and Stones, (which water cannot enter) and root themselves firmly in them. For just so the first sharp-pointed and most fine ends of the Umbilical vessels insinuate themselves by little and little into the pores of the Membranes (for the figuration of those pores are fitted for their entrance) and pass through them, and yet the liquors contained in these Membranes cannot flow out by them: and when those Vessels inhering in the pores grow more out into length, by little and little the said pores are more and more widened, (according to the increase of the Vessels) and are inseparably united unto and grow in them.

Urachus.

The fourth Umbilical vessel is the *Urachus* or Urinary vessel, and it is a small, membranous, round Pipe, endued with a very strait Cavity, arising from the bottom of the Bladder up to the Navel, out of which it passes along within the common cover, and opens into the *Allantoides*. It is more apparently pervious in many of the larger Brutes than it is in Man, in whom some have

have denied it any Cavity : but that it is hollow in him, is confirmed by many Histories of persons adult, who having the ordinary urinary passage along the *Penis* stopt, the passage in this Vessel has been unlocked, and they have made water by the Navel, which could not have been imagin'd to have happen'd, if it had been originally a Ligament without any *Meatus*. *Bartholin* and others have affirmed that the *Urachus* in Men reaches no further than the Navel ; How then comes that humour into the *Allantois* that has perfectly the same taste with the Urine in the Bladder ? But their error sprung from hence, that they thought an humane *Fetus* had no *Allantois*, and that humour that is found in it, they thought had been contained in the *Chorion*. But this is in short refuted above, but more fully and accurately by *Dr. Needham*, *lib. de formato Fetu*, cap. 3. As to the perviousness of the *Urachus* I shall add this further, that in abortions of five or six months old, the Bladder of the *Embryo* is always full of Urine, out of which if in the following months it should not be emptied by the *Urachus*, the Bladder would soon burst, seeing there is daily some *Serum* separated from the Blood in the Kidneys, and sent to the Bladder ; and the more the *Fetus* increases, the more must needs be separated.

Its use has been sufficiently declared in the preceding Paragraph ; as also above, when we delivered the use of the *Allantoides*, which we shall not repeat.

These four Vessels (as has been said above) *Funiculus* have one common cover, which also keeps each *lus*.
of

of them from touching other. It is called *Intestinulum*, and *Funiculus* (by which it with its Vessels is sometimes understood.) It is membranous, round and hollow, indifferent thick, consisting of a double coat, (the inner from the *Peritoneum*, and the outer from the *Panniculus carnosus*.) Sometimes it self only is wreath'd about like a Rope, the Vessels included in it running streight along its Cavity; and sometimes they are wreathed together with it.

its knots.

It has several knots upon it here and there, which Dr. *Wharton* thinks to be *Papille* or little Glands through which the lacteal (or nutritious juice) distils out of the capacity of the *Funiculus* into the Cavity of the *Amnios*. I cannot tell whether this be so or no, but that use that doting Midwives make of them, to guess by their number how many Children more the Mother shall have, and by their colour, whether those Children shall be Male or Female, is most ridiculous and superstitious.

How to tie the navel-string and cut it off.

When the Infant is born, this Navel-rope is used to be tied, about one or two fingers breadth from the Navel, with a strong thread cast about it several times, and then about two or three fingers breadth beyond the Ligature to be cut off. What is not cut off, is suffered to remain till it drop off of its own accord. Which the longer or shorter while it is a doing, the longer or shorter-lived, Women prophecy the Children to be.

Of the nutrition of the Fetus.

There have been great disputes among both Philosophers and Physicians, with what and by what way the *Fetus* is nourished. Some affirm by Blood only, and that received by the Umbilical

cal vein ; others by Chyle only, received in by the Mouth : each of which are in an extream. The truth is, according to the different degrees of perfection that an *Ovum* passes from a Conception to a *Fetus* ready for the birth, it is nourished diversly.

For first, as soon as an *Ovum* impregnated is descended into the Womb, it presently imbibes through its outer Membrane some of that albugineous liquor that at this time plentifully bedews the internal superficies of the *Uterus* ; so that as soon as the first lineaments of an *Embryo* begin to be drawn out of that humour contained in the *Amnios*, they presently receive increase by the apposition of the said liquor filtrated out of the *Chorion* through the *Amnios* into its Cavity. And this same liquor that thus encreaseth the first rudiments of the *Embryo* is called by Dr. *Harvey Colliquamentum* (as was noted above.) That this way of nutrition or augmentation of the *Embryo* is possible, need not be doubted by him that considers, that the *Fetus* of a Sow have no other possible way of being nourished till she is near gone half with Pig ; “ for even till then, “ saith Dr. *Needham*, the *Chorion* cleaves not to “ the Womb, but look as many *Fetus* as there are, “ there are so many Eggs as it were without “ Shells, neither sticking to the Womb nor to “ one another ; but when one opens the Matrix, “ they all tumble out of their own accord. There “ are no Glandules, no *Placenta*. But the *Chorion* “ which is soft and porous, does like a Sponge “ imbibe or suck up the serous liquor that sweats “ out of the inmost Membrane of the *Uterus*, to “ be afterwards swallowed by the Veins, (I suppose

First, by apposition.

pose he means the mouths of the Umbilical vein, after the said Vein is so perfectly formed as to receive it.) But of this more in the beginning of the foregoing Chapter.

2. By the
umbilical
vein.

But when the parts of the *Embryo* begin to be a little more perfect, and the *Chorion* becomes so dense that not any more of the said liquor is imbibed by it, the Umbilical vessels begin to be formed, and to extend to the side of the *Amnios*, which they penetrate, and both the Vein and Arteries pass also through the *Allantois* and *Chorion*, and are implanted into the *Placenta*, that at this time, first gathering upon the *Chorion*, joins it to the *Uterus*. And now the Hypogastrick and Spermatick arteries, that before spued out the nutritious juice into the Cavity of the *Uterus*, open by their orifices into the *Placenta*, where (whether by meer percolation through it, or by some sort of fermentation also, I will not determine, but) they deposite the said juice, which is absorbed by the Umbilical vein, and by it conveyed first to the Liver, then to the Heart of the *Fetus*, where the thinner and more spirituous part of it is turned into Blood. But the more gross and terrene part of it descending by the *Aorta* enters the Umbilical arteries, and by those branches of them that run through the *Amnios*, is discharged into its Cavity. They that will laugh at this passage of the nutritious juice, because it is made by this doctrine to choose its way as if it were some animal or even rational Creature, let them avoid the like treatment if they can while they deliver, that the Chyle passes immediately either from the Mesentery, the *Receptaculum* or *Ductus communis* to the *Placenta*, when a *Fetus* is

in the Womb. 'Pray how should the Chyle know, or the Lacteals by which it passes, that there is any *Fetus* in the Womb, that the one should offer to go that way, and the other give it way to go thither at that time, whereas the passage is shut at all other times? yet this my Opponents maintain. As also how comes the Chyle presently to turn its course after the *Fetus* is born, and instead of descending to the *Uterus*, ascend to the Breasts? What mechanical cause can be assigned to these and many other the like *Phænomena*? We must therefore be content to resolve some things into the admirable and unintelligible disposal of our wise Creator.

But there lies another objection against this opinion, Because it allows none of the Mothers Blood to be received by the *Fetus* through the Umbilical vein, but only *Succus nutritivus*; how should Blood be first bred in the *Fetus*, seeing it has Blood, before the Liver or Heart, or any other part that conduce to sanguification, are in a capacity to perform their office?

I confess it is inexplicable by me how Blood should be made so soon; but that it may be and is made, out of the *Succus nutritivus* or *Colliquamentum*, without the mixture of any from the Mother, is apparent from the most accurate observations of Dr. *Harvey* concerning the order of the generation of the parts in a Chicken, (which from first to last receives nothing from the Hen.) Says he, * "there appears at the * Dege-
"very first a red leaping *Punctum* or Speck, a nerat. A
"beating Bladder, and Fibres drawn from thence nimal. ex-
"containing Blood in them. And as much as ercit. § 1.

"one can discern by accurate inspection, blood is
 "made, before the leaping speck is formed; and
 "the same is endowed with vital heat, before it is
 "stirred by the Pulse: and as the pulsation be-
 "gins in the blood and from it; so at length, at
 "the point of death it ends in it. — And be-
 "cause the beating Bladder and the sanguineous
 "Fibres that are produced from it, appear first
 "of all; I should think it consentaneous to rea-
 "son that the blood be before its receptacles;
 "namely the content before its container; and
 "that this is made for the sake of the other.
 He confesses it to be a *paradox*, that blood should
 be made and moved, and endued with vital spirit
 before any sanguifying or motive organs are in
 being; and that the Body should be nourished and
 increased, before the organs appointed for con-
 coction (namely the Stomach and Bowels) are
 formed: but neither of these are greater para-
 doxes than that there should be sense and motion
 in the *Fetus* before the Brain is composed; and
 yet, says he, * "the *Fetus* moves, contracts and
 "stretches out it self, when there is nothing con-
 "spicuous for a Brain but clear water. I say if
 all these unlikely things do certainly come to pass
 in an Egg, that has nothing to set the vegetative,
 or vital principle thereof on work, but the
 warmth of the Hen that sits upon it; why should
 we think it strange that nutritious juice impreg-
 nated with the vital spirits of the Arterial blood,
 with which it circulated through the Mothers
 Heart (it may be more than once) should be
 turned into blood in an humane *Fetus* (fostered
 with such kindly warmth in the Womb) though
 it neither receive any humour under the form of
 blood

* Exercit.
 57.

bloud from the Mother, nor have it self as yet any organs of sanguification so perfect as to perform their office? But to proceed.

The grosser nutritious juice being deposited by the Umbilical arteries in the *Amnios*, as soon as the Mouth, Gullet and Stomach, &c. are formed so perfectly that the *Fetus* can swallow, it sucks in some of the said juice, which descending into the Stomach and Intestins is received by the *Vena lactea*, as in adult persons.

That the *Fetus* is nourished this way, *Diemerbroeck* evinces by these reasons.

1. Because the Stomach of the *Fetus* is never empty, but is found possess'd of a milky whitish liquor; and such like is contained even in its Mouth.

2. Because there are *Feces* contained in the Intestins, (which Philosophers call *Meconium*) which the Infant as soon as 'tis born voids by stool. Without doubt these are the excrements of some aliment taken in by the Mouth.

3. Because the Stomach could not presently after the birth perform the function of concoction, if it had not at all been accustomed to it in the Womb.

His fourth reason, supposing the *Fetus* to be nourished in part by the Mothers blood, I shall not recite, because I think that to be an erroneous opinion, as I think to make appear by and by.

5. Because the Infant as soon as it is born knows how to suck the Breast, which it could not be supposed to be so dextrous at, if while it remained in the Womb it had taken nothing by suction.

6. Because many Infants as soon as they are born,

“born, before they have sucked any Breast, or
 “taken any thing by the Mouth, vomit up a
 “milky aliment : which therefore must needs be
 “received into their Stomach in the Womb.
 This he gives an instance of in one of his own
 Children.

These Arguments I think sufficient to prove
 what they are alledged for ; but when he
 would afterwards prove that the *Fetus* is also
 nourished by the Mothers blood conveyed by the
 Umbilical vein, I think his reasons are invalid.
 For he says it must be so, *first*, because the said
 Vein is implanted into the *Placenta* ; (but this is
 but begging the question , for 'tis necessary it
 should be implanted into it though it receive no-
 thing from it but nutritious juice.) *Secondly*, be-
 cause of the great quantity of blood that will issue
 out of the Umbilical vein, if one tie the Navel-
 rope and then open the said Vein betwixt the Li-
 gature and *Placenta* : for he says there will flow
 out four times as much blood as could be supposed
 to be contained in the small Arteries on that side
 the Ligature next the *Placenta*. I answer, that
 first one would be well satisfied that the Ligature
 was made so strait, that there could no blood pass
 through it from the *Fetus* to the *Placenta*. And
 secondly it cannot exactly be guessed how much
 blood may be contained in the *Fetus's* Arteries in
 the *Placenta*, so as that one should be certain that
 there does four times more flow out by the Vein.
 But lastly, suppose there do four times as much
 more blood issue out of the Vein as is contained in
 the *Fetus's* Arteries that are on that side the Li-
 gature next the *Placenta*, and this blood come
 from the Dam's Hypogastrick and Spermatick
 arteries ;

arteries; I say there will not only four times, but forty times as much issue therefrom, for all the blood of the Dam might then be drawn out this way. Wherefore I think this experiment makes much more against his opinion than for it. His *third* reason is the necessity of it; because as the *Fetus* increases, it needs much aliment, and its weak Bowels can concoct but little, it must therefore have some purer aliment, and which is already concocted (he means blood) to nourish it, and by its commixture to help forward the changing the aliment received by the Mouth into blood.

Ans. This reason himself invalidates in the next Paragraph, * where he confesses that the *Fetus* in the Womb is nourished in the same manner as the Chicken in an Egg, which receives increase first by the *inner* White (as he distinguishes) by way of apposition; secondly it receives nourishment in by the Mouth from the *outer* White, and at the same time its Umbilical vessels enter the Yelk (to draw nourishment from thence) which, he says indeed, resembles the Mothers blood, but seeing it has not the least form of blood, why would it not be more plausibly said that it is instead of the *Succus nutritius* that the *Fetus* in viviparous Animals receives by the Navel-vein? And seeing these several liquors are turned, part of them, into blood in a Chicken, without any of the Hens blood to ferment them (as he speaks;) why should not the same power be granted to the vegetative or animal soul of the *Fetus* in the Womb, without any assistance from the Mothers blood? To which I shall add another Argument (out of Dr. Harvey) taken from Cæsarean births, when living Infants

* Anat.
corp. hum.
p. 367.

are cut out of the Mothers Womb, after she is dead. For if it had its life and heat from the Mothers blood; surely it should die as soon as she at least, if not sooner: for when death approaches, the subordinate parts do languish and grow cold before the principal; and therefore the Heart fails last of all. Wherefore the blood of the *Fetus* would first lose its heat, and become unfit for its office if it were derived from the Mothers Womb; seeing her Womb is destitute of all vital heat, before her Heart. But enough of this.

But some may object, If the *Fetus* be nourished by none of the Mothers blood, why should her *Menses* be stoppt all or most of the while she is with Child? To which I answer, that 'tis for the same reason that Nurses that give suck commonly want them also; for as in Nurses the chyle passes in a great proportion to the Breasts, whereby the blood being defrauded of its due and wonted share does not encrease to that degree as to need to be lessened by the flowing of the *Menses*; so in Women with Child, there is so great a quantity of the *Succus nutritivus* (which is only chyle a little refined and impregnated with vital spirit) that passes to the *Placenta* by the Hypogastrick and Spermatick arteries for the nourishment of the *Fetus*, that unless the Mother be very sanguine, her *Menses* intermit after the first or second month.

I shall conclude therefore, that the *Fetus* is nourished three several ways, but only by one humour: first by apposition of it while it is yet an imperfect *Embryo* and has not the Umbilical vessels formed; but after these are perfected, it
then

then receives the same nutritious juice by the Umbilical vein, the more spirituous and thin part whereof it transmutes into blood, and sends forth the grosser part by the Umbilical artery into the *Amnios*, which the *Fœtus* sucks in at its Mouth, and undergoing a new concoction in its Stomach is received out of the Intestins by the *Vena lactea*, as is done after the birth.

CHAP. XXXIV.

What parts of a Fœtus in the Womb differ from those of an adult person.

HAVING delivered the history of the *Fœtus*, we will only further shew in what parts a *Fœtus* in the Womb differs from an adult person. And this we cannot do more exactly than in the manner that *Diemerbroeck* has reckon'd them, whom therefore we shall here translate, with little alteration.

This diversity, he saith, consists in the difference of magnitude, figure, situation, number, use, colour, cavity, hardness, motion, excrements and strength of the parts.

Now this diversity is conspicuous either in the whole Body, or in the several Ventracles, or in the Limbs.

There is considerable in the whole Body,

1. The littleness of all the parts.
2. The reddish colour of the whole.
3. The softness of the Bones; whereof many are as yet gristly and flexible, and that by so much the more, by how much the *Fetus* is further from maturity.

In the Head there are several differences. As

1. The Head in respect to the proportion of the rest of the Body is bigger, and the shape of the Face less neat.

2. The bones of the Skull are softer, and the Crown is not covered with bone, but onely with a Membrane.

3. The bone of the Forehead is divided, as also of the under Jaw: and the *Os canisforme* is divided into four.

4. The bone of the *Occiput* or hinder part of the Head is distinguisht into three, four or five bones.

5. The Brain is softer and more fluid, and the Nerves very soft.

6. The bones that serve the sense of Hearing are wonderfully hard and big.

7. The Teeth lie hid in the little holes of the Jaw-bone.

There is no less diversity in the *Thorax*: For,

1. The Dugs swell, and out of them in Infants new born whether Male or Female, a serous Milk issues forth sometimes of its own accord, sometimes with a light pressure: yet there are no Glandules very conspicuous, but there is some fashion of a Nipple.

2. The *Vertebrae* of the Back want their spinous procelles, and are each one made of three distinct Bones,

Bones, whose mutual concourse form that hole whereby the spinal marrow descends.

3. The Heart is remarkably big, and its *Amicula* large.

4. There are two unions of the greater Vessels, that are not conspicuous in adult persons: viz.

1. The *Foramen ovale*, by which there is a passage open out of the *Cava* into the *Vena pulmonaris* just as each of them are opening the first into the right Ventricle, and the latter into the left Ventricle of the Heart. And this *Foramen* just as it opens into the *Vena pulmonaris* has a Valve that hinders any thing from returning out of the said Vein into the *Foramen*.

2. The *Canalis arteriosus*, which two fingers breadth from the *basis* of the Heart joins the *Arteria pulmonaris* to the *Aorta*. It has a pretty large Cavity, and ascends a little obliquely from the said Artery to the *Aorta*, into which it conveys the blood that was driven into the pulmonary Artery out of the right Ventricle of the Heart, so that it never comes in the left Ventricle; even as that blood that is sent out of the left Ventricle into the *Aorta* never came in the right, (except a little that is returned from the nutrition of the Lungs) but passed immediately into it out of the *Vena cava* by the *Foramen ovale*. So that the blood passes not through both the Ventricles as it does after the *Fetus* is born, for then it must have had its course through the Lungs, which it cannot have, because they are now very dense and lie idle and unmoved. Yea they are so dense and heavy that if one throw them into water they will sink, whereas if the *Fetus* be but born and take only half a dozen breaths, they become so spongy and light that they

they will swim. Which (by the way) may be of good use to discover whether those Infants that are killed by Whores, and which they commonly affirm were still-born, were really so or no, For if they were still-born the Lungs will sink, but if alive, (so as to breath never so little a while) they will swim.

5. The Gland *Thymus* is notably large, and consists as it were of three Glands.

In the lower Belly there are these differences.

1. The Umbilical vessels go out of the *Abdomen*.

2. The Stomach is narrower, yet not empty, but pretty full of a whitish liquor.

3. The Caul is hardly discernible, being almost like a Spiders web.

4. The Guts are seven times longer (or more) than the Body.

5. In the small Guts the excrements are pituitous and yellow, but in the thick somewhat hard and blackish, sometimes greenish: the *Cecum* is larger than usual, and often filled with *Feces*.

6. The Liver is very large, filling not only the right Hypochondre, but extends it self into the left side, and covers all the upper part of the Stomach. It has a passage now more than in the adult called *Canalis venosus*, which arising out of the *Sinus* of the *Porta* carries the greatest part of what is brought by the Umbilical vein directly, and in a full stream into the *Cava* above the Liver; but as soon as the Infant is born, and nothing comes any longer by the said Vein, this *Canalis* presently closes, as the Vein it self turns to a Ligament; as also do the *Urachus* and the two Umbilical arteries.

7. The

7. The Spleen is small.

8. The Gall-bladder is full of yellow or green choler.

9. The Sweet-bread is very large and white.

10. The Kidneys are bigger and unequal in their superficies, and look as if they were compounded of a collection of very many Glands.

11. The *Renes succenturiati* are exceeding large; they do not only border upon the Kidneys, as in the adult, but lie upon them, and embrace their upper part with a large *Sinus* as it were.

12. The Ureters are wide, and the Bladder distended with Urine.

13. In Females the *Uterus* is depressed, the *Tuba* long, and the *Testes* very large.

The difference in the Limbs consists

1. In the tenderness and softness of the Bones.

2. The little bones of the Wrist and Instep are gristly and not firmly joyned together.

CHAP.

CHAP. XXXV.

Of the Birth.

THE *Fetus* swimming in the liquor of the *Amnios*, and the Navel-rope being so long, it must needs have scope enough to change its situation, and that is the reason that Anatomists differ so much about it. But according to Doctor *Harvey* its usual posture is thus.

The posture
of the *Fetus*
in the
Womb.

“ Its Knees are drawn up to the Belly, its Legs bending backwards, its Feet across, and its hands lifted up to its Head, one of which it holds to the Temple or Ear, the other to the Cheek; where there are white spots on the Skin as if it had been rubb’d upon. The Back-bone turns round, the Head hanging down towards its Knees. Its Head is upwards and its Face commonly towards the Mothers Back.]

At its
birth.

But towards the birth (sometimes a week or two before) it alters its situation, and tumbles down with its Head to the neck of the Womb, with its Feet upwards. Then the Womb also settles downwards and its orifice relaxes and opens. And the *Fetus* being now ill at ease sprawls and moves it self this way and that way, whereby it tears the Membranes wherein it is included, so that the Waters (as they call them) flow into the *Vagina*, which they make slippery for the easier egress of the Infant: though sometimes the Membranes burst not but come forth whole, (as they

they do commonly in Brutes.) At the same time the neighbouring parts are loosened and become fit for distension: the joyntings of the *Os sacrum* and *Pecten* with the *Coxendix*, as also of the *Ossa pubis* are so relaxed, that they yield very much to the passage of the *Fetus*. And its motion gives that disturbance to the *Uterus*, that presently the animal spirits are sent plentifully by the Nerves to its constrictory Fibres, and the Muscles of the *Abdomen*, which all contracting together, very strongly expell the *Fetus*, which (in the most natural birth) goes with the Head foremost: and if the Feet or any other part (besides the Head) do offer it self first, the travail is always more painfull and dangerous.

The severall sorts of Creatures have sundry terms of going with young: The stated and most usual time of Women is nine months; though some bring forth some weeks sooner and others later. But when it is given out that perfect and sprightly Infants are born at seven months end; it is either to hide the faults of some new-married Woman, or from the mistake of the ignorant Mother. As also when sometimes the Mother has affirmed her self to go eleven months or upwards, it is either through mistake, or to keep fast some fair Estate, when the pretended Father's dead without an Heir, for which the cunning Widow plays an after-game. *The term of going with child.*

Divers reasons are given why the *Fetus* at the stated time of birth is impatient of staying any longer in the Womb. As the narrowness of the place, the corruption of its aliment or the defect of it, the too great redundance of excrements in the *Fetus*, and the necessity of ventilation or breathing. *The reason of the birth.*

breathing. All these are plausibly defended by their several Authors. But without blaming ingenious Men for exercising their wits on such a Subject, we choose however rather to be content with resolving all into the wise disposal of the great Creatour, whose power and wisdom were not more eminent in creating Man at first out of the Dust of the Earth, than out of those principles and in that method whereby he is produced in ordinary generation.

The Explanation of the Table.

Figure I.

Representeth the usual situation of the *Fœtus* in the Womb.

A Its Head hanging down forwards, that its Nose may be hid betwixt its Knees.

BB Its Buttocks, to which its Heels close.

CC Its Arms.

D The Umbilical rope passing by its Neck, and wound round over its Forehead.

Figure II.

Sheweth the *Fœtus* taken out of the Womb and as yet tyed to the *Placenta*, the Umbilical vessels being separated at their rise.

AAA The Abdomen opened.

B The Liver of the *Fœtus*.

C The Urinary bladder.

DD The Intestines.

E The



Fig. 2.

Fig. 1.



E *The Umbilical vein.*

FF *The Umbilical arteries.*

G *The Urachus.*

H *The Umbilical vessels united and invested in their common Coat.*

I *The Funiculus umbilicalis reaching to the Placenta.*

KKKK *The Veins and Arteries dispersed through the Placenta.*

LLL *The Placenta of the Womb.*

The end of the First Book.

The Second Book.

OF THE
B R E A S T.

CHAP. I.

Of the common containing parts of it.

Hitherto of the Lower Belly or *Abdomen*, *The Breast*, and of the parts contained in it, whether appointed for Nutrition or Procreation: Now it followeth that we describe the middle Cavity, called *Thorax*, which containeth the Organs of elaborating the Bloud and Vital spirits, and the rise of the Vessels whereby they are distributed into all the parts of the Body, for their instauration, and the preservation of their natural heat.

It is bounded above by the *Clavicula* or Chancel-^{*Its limita-*} bones, below by the Diaphragm or Midriff^{*tion.*} (whereby it is severed from the *Abdomen*;) in the fore-part by the Breast-bone and Cartilages;

p in

in the Sides by the Ribs ; behind by the *vertebra* of the Back.

Figure.

The *figure* of it is in a manner oval, somewhat flat before and behind, (whereas in Beasts it is somewhat sharp :) So that only Man lieth on his Back.

Parts.

The *parts* whereof it is composed, are either containing, or contained. The parts containing are either common or proper.

The common containing parts.

The *common containing parts* are in number four, *Cuticula*, *Cutis*, *Pinguedo*, and *Membrana carnosa*. Of which having at large discoursed in Book I. Chap. 3. when we treated of the common containing parts of the Lower Belly, we shall not here repeat what is there delivered, but only shew some small matters wherein they differ. As

1. *Cuticula.*

First, the Skin and Scarf-skin are hairy under the Arm-pits, and above the pit of the Heart ; the Skin of the Back is both closer and thicker, and so is less hairy.

2. *Cutis.*

Secondly, the Skin of the back-parts is of a more exquisite feeling : first, because many twigs of Sinews are bestowed upon it from the *Nerves* proceeding from the *Spinalis medulla* ; secondly, by reason of the Muscles of the *Thorax* that lie under it, which being tendinous are very sensible.

3. *Pinguedo.*

As for the fat, it is not so plentiful here, as in the Belly : first because the natural heat here is sufficiently preserved without it ; secondly, because it would have hindred the motion of the Breast. Only here it is somewhat yellowish.

4. *The membrana carnosa.*

The *Membrana carnosa* hath nothing peculiar, saving that in the fore-part of the Neck it is more fleshy, and assumes the nature of a Muscle where

where the *Musculus quadratus* is framed, which pulleth aside the Cheeks and Lips, (according to *Spigelius*.)

CHAP. II.

Of the proper containing parts; and first, of the Dugs.

THE proper containing parts are either external The proper containing parts of the breast. or internal. The external are in number throe, the Dugs, the Muscles, the Bones. The internal proper containing parts are three in like manner; the *Pleura*, the *Mediastinum*, and the Diaphragm.

Dugs are granted to both the Sexes, and are The paps; seated in the middle of the *Thorax*, on each side one, upon the pectoral Muscle that draweth the Shoulder forwards.

In Men they are framed of the *Cutis*, the *Membrana carnosæ*, Fat, and the Nipple, and serve only for beauty, and are called *Mammilla*. 1. Of Men.

In Women, besides these parts, they have remarkable Vessels, Glandules, and Pipes to contain the Milk separated by the Glandules, and are called *Mamma*. 2. Of Women.

They differ much as to their bigness in several Women, and in the same Woman in regard of age and other circumstances: for before they have their *Menses*, and when they are very old, they bunch out but very little. And in the middle or flower of their age, when they give suck or are with Child, they are bigger than at other times. Their bigness.

Glands.

They are made up of many glandulous bodies of a different bigness, and are not of one continued glandulous substance (as Dr. *Wharton* affirmeth, *lib. de Gland. p. 236.*) there is one in the middle just under the Nipple that is bigger than the rest. The spaces between the Glands are filled up with fat, and there are abundance of Vessels that go from one to another. They are all inclosed by the *Membrana carnosæ*, and make up as it were an half globe. They are whiter of substance in Women than in Brutes. Through these Glands the Milk is separated from the Bloud, being nothing but the Chyle issuing out of the left Ventricle of the Heart with the Bloud (to which it is not as yet assimilated) and driven hither along the Thoracick arteries. Unless we will admit *Vena lactea* to come hither, which opinion we shall examine afterwards.

Papilla.

Upon the middle great Gland standeth the *Papilla* or Nipple, which is round and of a spongy substance, covered with a very thin Skin, and has many little holes in it for the Milk to distil out by when the Child sucketh it. It is of an exquisite sense, and resembles something the *Glans* of a Man's *Penis*, in that by handling or sucking it becomes erect or stiff, being otherwise commonly flabby. It is red in Virgins, livid in those that give suck, and blackish in old Women. All the *Tubuli lactiferi* or Milk-conduits end in it.

Its bigness.

It differs in bigness, being as big in some as a Mulberry, in others as a Raspberry, in others less: when Women give suck, it is longer than at other times.

Use.

Its use is, to be like a Pipe or Tunnel, which the Child taking in its Mouth may suck the Milk through

through out of the Breast : And it is of so exquisite sense that the Milk passing through it may cause a kind of titillation, whereby Mothers and Nurses may take the greater delight and pleasure to suckle their Infants.

There is a little circle that surrounds it called *Areola*. *Areola*, which in Virgins is pale and knotty ; in those that are with Child or give suck, brown ; and in old Women, black.

The Breasts have all sorts of Vessels, Veins, *Their vessels.* Arteries, Nerves, Lympheducts, which are common to them with other parts ; and *Tubuli lactiferi* proper to themselves, and, according to some, *Vena lactea*. Of all these in order.

The *Veins* are of two sorts, for some are *external*, some *internal*. The *external* spring from the *Axillar* branch, and run only under the Skin which covereth the Dugs, and are called *Thoracica superiores*, or the uppermost Breast-veins. And these are they that look so blue in the Breasts of fine-skin'd Women. The *internal*, called *Mammaria*, spring from the *Rami subclavii* : They are in number two, on each side one. These enter in among the Glands of the *Mamma*, where they send forth a great many branches ; but descending thence by the *Mucronata cartilago*, they pass out of the Breast, and go downward under the *Musculi recti*. When they are come to the umbilical region almost, they are said to be joyned by fundry inosculation with the *Vena epigastrica*, which meet them there ; though most late Anatomists deny any such inosculation.

These *Vena epigastrica* spring from the external *Ramus iliacus*, and by a streight way pass upward under the aforesaid Muscles. And from the in-

ternal branch of the said *Ramus* spring the *Vena hypogastrica*, which are inserted into the neck and bottom of the Matrix. Of which in Book I. when we treated of the Womb.

Arteries. They have the same number of Arteries as Veins, and of the same denomination, viz. *Arteria thoracica superiores* which are sent forth from the Axillar, and *Arteria mammaria* in like manner which spring from the Subclavian, and from the Breasts descend to about the Navel. Whether when they are come, they are said (but erroneously) to be united by inosculation with the *Arteria Epigastrica* ascending. The use of both Veins and Arteries shall be shewn by and by when we come to the use of the Breasts.

Nerves. They have Nerves (according to *Spigelius*) from the fourth Intercoastal nerve springing out of the vertebral marrow of the *Thorax*, which about the middle of the Rib, perforating the Intercoastal Muscle, is divided into four branches, which are sent afterward to the pectoral Muscle, and so into the Breasts, the thickest passing to the Nipple.

Lympheducts. They have very many Lympheducts. Doctor *Wharton* saith they are very conspicuous and numerous in the *Ubers* of Cows, but one can hardly trace them into the *Parenchyma*. Wherefore (saith he) 'tis likely that they carry back all the exhalations resolved into sweat by help of the Membranes—which they rather minister to than to the *Parenchyma*.

Tubuli lactiferi. Besides these four sorts of Vessels that are common to them with most other parts of the Body; they have proper to themselves certain lactiferous (or milk-carrying) Pipes, which are the

the Store-houses wherein the Milk is reserved, and through which as by Conduits it flows to the Nipple when the Child sucks. *Bartholin* has observed ten or more of them, full of Milk in Women giving suck, with their outer ends encompassing the *Papilla* circular-wise, each of which as they pass further into the Breasts, are divided into sundry branches, which end in the Mammary glands (above spoken of) from whence they bring the Milk, and pour it into the common duct of the *Papilla*.

The several branches of these *Tubuli* amongst the Glands many do take for true Lacteals, and therefore do believe that there are some *Vena lactea* that conduct the Chyle directly to the *Mamma*. But from whence those Lacteals have their origine, is not agreed among the defenders of that opinion. Some affirm them to rise from the Stomach, some from the *Pancreas*, and some from the *Ductus thoracicus*. The truth is, it is no wonder they should not agree concerning their rise, seeing the opinion is grounded more upon rational conjecture, than ocular discovery. For as was said in the former Book (Chap. 32.) discoursing of the *Vena lactea* their being said to convey the liquor into the *Amnios*, That that were a plausible opinion, if such could be demonstrated by Anatomy; so we may say as to their conveying the Chyle to the Breasts, where it comes to be called Milk. But with all due respect and deference to the Espousers of this Hypothesis (such as the most learned Sir *George Ent*, *Caspar Martianus*, *Diemerbroeck*, &c.) we must crave leave to dissent therefrom (with Doctor *Wharton*, Doctor *Needham*, &c.) till there shall be ob-

Vena lactea.

The use of
the Mam-
mary.

served more certain footsteps of such Vessels.

The use of the Breasts in Women is to prepare or separate Milk for the nourishment of the Child. Which how it is done, we shall shew in as few words as may be.

It was an old opinion that Milk was made of Blood sent from the Womb by the Epigastrick vessels ascending, and as was thought inosculating with those branches of the *Mammaria* that descend towards the Navel. But as later Anatomists have found those anastomoses only imaginary (invented to serve an Hypothesis;) so it is generally denied that either Blood sent from the Womb, or from wheresoever, is the true matter out of which Milk is made. For not to mention (which yet is very considerable) that it is incredible that the Mother could every day endure the loss of so much Blood (suppose a pound and half) as the Child sucks daily Milk from the Breasts; I think the argument urged by Dr. *Wharton* may satisfy any Man. *Viz.* "Nature does nothing in vain; she goes not forward and backward by the same path. But if she make Blood of Chyle (*which is certain*) and then make Chyle of Blood again, she goes so. For Chyle is a sort of Milk, as appears by the opening of the Lacteal veins. If therefore that Chyle be first excocted into Blood, and then return again to the nature of Milk, Nature should certainly frustrate her first work.] We shall not therefore spend further time to refute so improbable (and now obsolete) an opinion; but shall avow, that Chyle is the true matter out of which Milk is made, which is done after this manner.

The

The Chyle being received into the common receptacle from the *Vena lactea* of the Mesentery, ascends up by the *Ductus thoracicus*, and by it is conveyed into the subclavian Veins, where it is mixed with the Blood, and from whence it is circulated with it through the ventricles of the Heart. And when it comes out of the left Ventricle by the *Aorta*, a good part of it (as yet not assimilated to the Blood) is sent to the Breasts by the Mammary and Thoracick arteries, whose Capillaries are inserted into the Glands, through which it is strained or filtrated into the *Tubuli lactiferi*, even as the *Serum* of the Blood is separated from it by the Glands of the Kidneys into their *Tubuli* or Syphons. And as those Syphons of the Kidneys carry the *Serum* into the *Pelvis*, so do these of the *Mamma*, the Milk into the common duct of the Nipple. As for the Blood that came along with the Chyle to the Glands, that returns back again into the Subclavian and Axillar veins, and so to the Heart.

Besides this matter of the Milk (viz. Chyle) Dr. *Wharton* (suitable to his Hypothesis of the *Succus nutritivus* of the Nerves) thinks that the Nerves contribute their share, which he calls spermatick, for the nourishment and encrease of the spermatick parts of the Child. But if it should be supposed that the Nerves have such *Succus* in them (which we do not believe) what weakness must it needs induce upon the Mother to have so much of it (with the animal spirits) daily drain'd out of them ? whereas we see that many Women are more chearfull and healthfull when they give suck, than at other times. We cannot therefore consent to that opinion.

And

How milk
is made.

And here a most difficult question may arise, why the Chyle (whether it be brought by some *Vena lactea*, or by the Arteries) flows only to the Breasts at some certain times, and not always, seeing the Vessels that carry it are not obliterated, nor it self exhausted.

Why it
flows to the
breasts at
some times
only.

They that taught, that the Milk was made of Bloud, and that that Bloud was sent from the Womb by the Hypogastrick vessels inosculating with the Mammary; these I say deriving the Milk from the Menstrual blood as its matter out of which it is made, thought that the stopping of the *Menses* (as commonly happens to Nurses, unless very plethorick) occasioned the regurgitation of the Bloud by the said Vessels up to the Breasts, where so free a vent was found for it, after it was first changed into Milk by their Glandules. They assigned the same blood for the nourishment of the *Fetus* in the Womb, and that after the birth it ascended up to the Breasts. But having in the former Book (Chap. 33.) shewn that the *Fetus* is not nourished at all by the Mothers blood, as also in this Chapter that Milk is not made of it; we need not (though it were easie to) shew how ill this Hypothesis would satisfy the question, if Bloud should be supposed the material cause of the Milk. And indeed it is far easier to invalidate the reasons that have been urged for it, than to produce any new ones that are more satisfactory. For as above (in Book I.) discoursing of the manner and matter of the nourishing the *Fetus* in the Womb, we scrupled not to expose our selves to the smiles of our so oversagacious *Virtuosi*, in resolving all into the wise disposal of the Creatour; so we shall not be ashamed

ashamed to profess our (I think invincible) ignorance in this also, and acquiesce in the wise providence of Nature. However we will not omit to give *Diemerbroeck's* opinion, which if it cannot satisfy, may for its ingeniousness delight.

"The cause of it (says he) is a *strong imagination*, or an intense and often thinking of "Milk, Breasts and their Suction, which worketh wonderfull things in our Bodies: not indeed simply of it self, but by mediation of the "appetitive power, or of the passions of the "mind, which induce various motions on the "spirits and humours. So the imagination and "thinking of a great danger maketh a Man "tremble, fall, be cold, fall into a swoon, yea "hath sometimes turn'd all the hairs grey in a "short time: The imagination of a joyfull matter causeth heat and animosity of the Body: "thinking on a shamefull thing, or a view of it, "causeth blushing; thinking on a terrible thing, "paleness; on a sad thing, cold. Lustfull "thoughts make the Body hot, relax the strict "Genitals of Women, erect the *Penis*, and do so "open the seminary ways that are otherwise invisible, that Seed issueth out of its own accord "in involuntary or nocturnal pollution. The "same intense imagination (*adds he*) and "a desirous cogitation of suckling the Infant, is "the Cause that the Chyliferous vessels (*by which he means Venæ lactæe properly so called*) are "loosened and opened towards the Breasts, especially if some outward causes tending that way "favour and further incite that strong imagination, as wanton handling of the Breasts, the moving of the *Fetus* in the Womb, the sucking of
"the

“the *Papilla*, &c. For according to the different
 “influx of the Animal spirits, the parts are some-
 “times straitned, sometimes relaxed, as every
 “one knows; and according to that different
 “constriction or relaxation the Bloud and other
 “impelled humours, flow sometimes more, some-
 “times less into the parts; and sometimes beget
 “heat, softness, redness; sometimes constricti-
 “on, cold and paleness. Amongst these impel-
 “led humours is the Chyle, &c. —] To
 confirm this opinion he gives several instances
 wherein nothing but imagination could move the
 Chyle to tend to the Breasts. His first is that
 known story of *Santorellus*, “That a poor Man’s
 “Wife dying, and not having Means enough to
 “hire a Nurse for the Infant she had left behind
 “her, he used, (to still it a little) often to lay
 “it to his Paps (without doubt (says *Diemer-
 “broeck*) with a great desire to yield it some
 “Milk) and so at length by that intense and con-
 “tinual thought, and often repeated sucking of
 “the *Papilla*, his Breasts afforded Milk enough
 “for the suckling the Infant. (Which, by the
 way, seems to make much against his opinion of
 the Chyle’s being conveyed to the *Mamma* by the
Vena lactea; for seeing Men according to Nature
 give no suck, to what purpose should *Vena lactea*
 be distributed to their *Mammilla*? and yet here is
 an instance of a Man giving suck, and therefore
 the Chyle is more likely to be brought by the
 Arteries, which Men have as well as Women;
 unless we will grant that force to imagination,
 to make *Vena lactea* as well as to send the Chyle
 by them, which would be an equal force of
 imagination to imagine. But to proceed.) He
 tells

tells another story of an old Woman that came to give suck, and he delivers it with such circumstances as may create a belief of the truth of it.

"At *Vyanen* a Town not far from us (*viz.* from "*Utrecht*, in which Province it is) about thirty years agoe there was an Hostess that kept the "Bores-head Inne without the Gate, who was "brought to bed a little after her Husbands "death, and died in Child-bed or very soon after, leaving a healthfull Child behind her: "and having left very little Estate, her Mother "whose name was *Joan Vuyltuyt*, being also poor "and not able to put it out to Nurse, yet had "such pity on her Daughters Child, as to undertake to nourish it, and she was now threescore "and six years old. Now having sometimes used, "with the greatest commiseration, to hold it to her Breasts when it cried, and offered it the "Nipple to suck; by that strong imagination, "and desirous cogitation of nourishing the Infant, "her Breasts began to give Milk, and that in a "few days so plentifully, as was abundantly sufficient to feed the Child, so that it had scarce any "need of other sustenance: and so, to the admiration of all, the Infant was well nourished "with the Milk of this old Woman, whose "Breasts for many years had been wither'd and "flaggy, but now became plump and full like a "young Woman's. There are many still alive in "that City that remember the thing very well.]

I confess the story is very odd, but whether to be resolved into the force of imagination I leave the curious to meditate. However he very plausibly answers several objections that may be made against it, which it will be worth the while for the

the Latine Reader to peruse, in his *Anat. corp. human., lib. 2. cap. 2. p. 409, 411, &c.*

The two other proper containing parts of the *Thorax* are the *Muscles* and the *Bones*.

As for the *Muscles*, they are set down in the *Treatise of Muscles, Book 5. cap. 15.*

The *Bones* are set down in the *Doctrine of Bones, Book 6. cap. 11, 12, 13.*

CHAP. III.

Of the proper internal containing parts.

THESE are in number three, the *Pleura*, the *Mediastinum* with the *Thymus* growing to it, and the *Diaphragm*.

Pleura.

The *Pleura* hath its denomination from the *Ribs* under which it is placed, (for a *Rib* is in Greek called *ῥαβδος*) and so it may be termed in English, the *Costal membrane*.

Its substance.

It is a *Membrane*, white, thin, hard, resembling the *Peritoneum*, and lining all the cavity of the *Thorax*.

Spigelius de human. corp. fabr. lib. 6. cap. 3. will have it to be thicker and stronger than the *Peritoneum*, contrary to the opinion of *Riolanus*, who affirmeth the *Peritoneum* to be thicker and stronger, because it is appointed for the sustaining the weight of the *Guts*.

Parts.

It is every where double: The inner part is thickest, smoothest, and as it were bedewed with
a wa-

a waterish humour, that it should not offend the Lungs by its roughness: This waterish humour doth spring from the vapours raised from the Blood, condensed by the respective coldness of the Membrane. The outer part is thinner, yet is rougher; that it should cleave the more firmly to the Ribs, and Muscles.

As for its figure, without it is arched, within *Figure.* hollow; above it is narrower, below broader, chiefly towards the Sides. From it sometimes spring some sinewy Fibres, by the which the Lungs are tied to it. If these be too strait, the motion of the Lungs is hindered, and so an incurable difficulty of breathing procured.

Above, it is perforated in six or seven places, *Holes.* to give way to the *Vena cava*, and the *Aorta* ascending, the *Gula*, the Wind-pipe, Lacteals, Lympheducts and Nerves. Below, where it covereth the Midriff, it is perforated in three places, to give way to the *Vena cava*, and the *Aorta* descending, as also to the *Gula*.

It is said to be framed of the Membranes cover- *Rise.* ing the *Spinalis medulla*, from whence it comes forward on each hand by the sides to the Breast-bone, under which the Membranes of each side are joyned together, and so being doubled it goes back again streight from the middle of the Breast to the Back, dividing the cavity of the *Thorax*, and the Lungs also, into two parts, like a partition-wall, and this is called *Mediastinum*, of which by and by.

Its Veins spring from the superiour Intercoastal *Veins.* branch, and from the *Vena sine pari*.

The Arteries in like manner proceed from the *Arteries.* superiour Intercoastals, (which arise from the Subcla-

Subclavian) and these descend to about the fourth Rib, below which it has its Arteries from the hinder part of the *Aorta* descending.

Nerves.

It hath twelve Nerves according to the number of the *vertebra* of the *Thorax*; from betwixt each of which there springs a pair of Nerves, and each pair is immediately divided into the *fore-* and *hinder-branches*: The *fore-branches* are they which serve the Intercoastal muscles, external and internal, and also the *Pleura*: as for the *hinder*, they are bestowed upon the Muscles which are placed upon the Back.

The Veins and Arteries according to *Spigelius* run between the two Membranes of the *Pleura*, and therefore he thinks that when an inflammation of the *Pleura* (called a *Pleurisie*) imposthumates, the matter is rather gathered betwixt its Membranes than betwixt the Intercoastal muscles and it.

of the Mediastinum.

The second proper internal containing part is the *Mediastinum*: so called because it standeth in the middle of the Breast, and divideth the right side from the left.

Its rise.

It springeth from the Membranes of the *Pleura* meeting at the *Sternum*, (as was said before) so that at its rise it consists of four Membranes, because the *Pleura*, of the duplicature whereof it is made, consists of two. But as the *Mediastinum* tends from the *Sternum* through the middle of the *Thorax* towards the Back, its duplicated Membranes are so severed, that the Heart with its *Pericardium* are contained in its Cavity. Yet when they arrive near the Back, they join again as close as they did at the Breast, though they presently

presently part again, (saith *Diemerbroeck*) and make another narrower Cavity, but as long, for the Gullet, &c. to descend by. Some have formerly imagined a third Cavity at its origine under the *Sternum*, wherein they thought there were sometimes collected corrupt humours, that were the cause of many occult Distempers. And indeed if the dissection be begun at the *Sternum*, when one has pull'd it off from the *Mediafinum*, one would think at first sight that there were as great a distance betwixt the Membranes of the *Mediafinum*, as the *Sternum* is broad. But it is a great error, for if one begin the Section at the Back and loose the Ribs there, and so come to the *Sternum*, he will see the *Pleura* doubled knit close to the *Sternum* without any Cavity.

The substance of it is membranous; where it *Substance.* is parted, it is thinner and softer than the *Pleura*. The outer side towards the Lungs is smooth, and hath fat about the Vessels; but the interior is rougher, by reason of the Fibres whereby it adheres to the *Pericardium* in some places, and its own two Membranes at their meeting are united.

It reacheth from the Throat to the Midriff. *Length.*

As for its Vessels: Veins and Arteries it hath *Veins.* from those called *Mammaria interna*, but small; *Arteries.* and Veins besides from *Vena sine pari*.

It hath moreover one special Vein called *Mediafina*, which springeth from the lower part of the *Ramus subclavius*.

The Nerves called *Phrenici*, and *Stomachici*, *Nerves.* springing from the sixth pair, (Dr. *Willis's* eighth) descend betwixt its Membranes, and send forth small twigs into it.

Lympheducts.

Bartholin says it has *Lympheducts*, which rising here and there in many *Rivulets*, enter the *Ductus thoracicus* at last in one channel. These imbibe the water that is condensed betwixt its duplicature, and convey it into the said duct.

use.

It hath three *uses*: *First*, it divideth the Breast and Lungs into two parts, that one being wounded or any way hurt, the other might perform the task of respiration.

Secondly, it holdeth up the Heart inclosed in the *Pericardium* so, that it may not rest upon the Back-bone, when we lie upon our Back; or fall upon the Breast-bone, when we bend our selves towards the ground; or touch the Ribs, when we lie upon our Sides.

Thirdly, it giveth a safe passage to the Vessels which pass by it, and holdeth up the Diaphragm so that it is not pulled too much down by the weight of the Bowels that hang by it, *viz.* the Liver and the Stomach.

Thymus.

To the upper part of the *Mediastinum* at the Throat there groweth a Kernel called *Thymus*, seated between the divisions of the Subclavian veins and arteries. It is a whitish, soft, spongy, glandulous body, (in shape resembling a Tyme-leaf, from which it has its name.) It is larger in Children and Women than in Men. In Infants it consists of three Glands, and is in substance something like the Sweet-bread; but in adult persons it dries up and contracts into one continued substance.

Its vessels.

The Jugular *Veins* and *Arteries* pass through it as they go up to the Neck, but if they send forth any twigs into it, they are so small as not to be discovered in dissecting it. - *Dr. Wharton* says it has

has *Nerves* from the sixth pair and from the subclavian *Plexus*, which deposite their *Succus nutritivus* in it, whose superfluous or impurer parts are separated from it in this Gland and conveyed away by the *Lympheducts*, and the refined liquor is resumed by the *Nerves* dispersed in it, for the use of the nervous parts of the whole Body. And because he foresaw how open this opinion (which himself calls *scruposa sententia*) lay to the objection, that it is very improbable that the *Nerves* should bring the *Succus nutritivus* to this part. and after depuration should resorb it; he answers that either the *Nerves* must do it, or it cannot be done at all, seeing there are no other *Vessels* fit for the resuming of it. But he had better have suspected his supposed office of the *Thymus*, when he saw himself so hard set to maintain it. For it is more probable that when there is found any whitish liquor in it, (as there is in Infants, and in Calves, &c.) that liquor is *Chyle* which is brought thither by *Lacteals*, and descends from thence into the Subclavian veins; seeing if one kill a Calf about two hours after it has been plentifully suckled, the *Thymus* abounds with this juice, as *Diemerbroeck* affirms; who also denies that there are any perceptible *Nerves* inserted into it, but grants *Lympheducts*.

Its uses are, first, to prop and strengthen the *Use* divisions of the *Vessels*, namely of the *Vena cava* and great Artery; and secondly, to defend them from compression by the *Clavicula*, in stooping forward. In adult persons it seems to be of little other use; but in Infants, in whom it is larger and has liquor-like *Chyle* in it, it seems to contribute something towards the refining or depuration of it.

*The Dia-
phragm.*

The third and last internal proper containing part is the Midriff or Diaphragm (derived ^{and} *ὁ διαφραγμῶν*, to distinguish, because it divides the trunk of the Body into two Ventracles, the *Abdomen* and *Thorax*.) It is also called *σπῆρ*, or *σπῆρας*, the mind, because when it is inflam'd or otherwise much distempered, the mind and senses are disturbed, through the great consent it has with the Brain, as being a very nervous part. The Latines call it *Septum transversum* for the same reason as the Greeks call it *Diaphragma*.

Now this part being truly a Muscle assisting respiration, we might on that account have deferred to treat of it till we come to describe the Muscles of the *Thorax*: but because it is wholly an internal part, and serves to make up the cavity of the Breast, we rather chuse to discourse of it here, and omit it in the treatise of Muscles.

*Its figure
and situa-
tion,*

It is almost round, (excepting its two appendages whereby it is fastened to the Muscles or *vertebrae* of the Loins) and is seated transversly or across the Body, only sloping a little backwards. It is as broad as the width of the *Thorax*, for its edges are fastened to the lower part of the *Sternum*, to the ends of the lowest Ribs, and to the lowest *vertebra* of the *Thorax*.

Substance.

Its circumference is carnous, but in its middle or centre (as it were) it is nervous and membranous, for thither do all the carnous Fibres run from the edges. Wounds in the nervous part of it are mortal, because the party presently falls into Convulsions, and respiration faileth; but if it be wounded in its fleshy part, the patient oft escapes. It is clad with two Membranes, the

the upper from the *Pleura*, to which the *Mediaſti-num* and *Pericardium* are joined, and ſometimes the loweſt tips of the lobes of the Lungs; the under, from the *Peritonæum*.

It is perforated on the right hand near the nervous centre by the trunk of *Vena cava* aſcending from the Liver, and on the left hand near the ſaid centre by the Gullet and two Stomachick nerves ſpringing from the *par vagum*. Behind at the *Vertebra* there deſcend betwixt its two appendages or productions the *Aorta*, a branch of the *Vena azygos*, and the Intercostal nerve (diſtinguiſht from the *par vagum* by Dr. Willis) for the uſe of the parts of the *Abdomen*.

It has two *Arteries*, called *Phrenica*, from the *Vessels*. *Aorta* deſcending, and as many *Veins* from the trunk of *Vena cava* aſcending through it. Nerves it hath firſt from the ſecond pair of the *vertebra* of the Neck which (according to Dr. Willis) communicate with the Intercostal pair. By this communication of the Intercostal nerve with that from whence this Nerve of the Diaphragm ſpringeth, yea with this Nerve it ſelf, (for the ſaid Author ſays that two or three Nerves are ſent from the cervical *Plexus* of the Intercostal into the trunk it ſelf of the Nerve of the Diaphragm) he very ingeniouſly gives a reaſon of the great conſent of the Midriff with the Heart, Brain and Face, when a Man laughs. "For," ſays he, as often as the imagination is affected with ſome pleaſant or wonderfull conceit, the Heart would preſently ſain triumph (*ovare*) and be lighten'd by throwing off its burthen as it were: wherefore that the Blood may the quicklier be emptied out of its right Ventricle

“into the Lungs, and consequently out of the
 “left into the *Aorta*, the Diaphragm being in-
 “stigated by the Nerves that goe to it from the
 “abovesaid *Plexus*, is drawn upwards with a
 “more rapid *Systole*, and often repeating its
 “jumps as it were, it bears up the Lungs, and
 “causes them the quicker and frequenter to dis-
 “charge the Air and Bloud: and then inasmuch
 “as the same Intercoastal nerve, that communi-
 “cates below with the Nerve of the Diaphragm,
 “is also continued above with the Maxillar
 “nerves, when a cackling is begun in the Breast,
 “the gestures of the Mouth and Face pathetically
 “answer thereto.] And when the Diaphragm
 is wounded in its nervous part, then the Muscles
 of the Face suffer Convulsions, and the laughter
 called *Risus Sardonius* (which is involuntary) is
 caused. Besides the abovesaid Nerves it has
secondly small twigs from the Stomachick
 nerves and Intercoastal as they descend through
 it.

v.c.

Its use is *first* to divide the *Tborax* from the
Abdomen, that noisom and impure vapours may
 not ascend from the more ignoble parts as the
 Guts, to offend the more noble as the Heart, &c.
Secondly, to help the Muscles of the *Abdomen* in
 compressing and excluding the excrements, and
 (in Women) the *Fetus*. But *thirdly*, its chief
 use is to assist respiration, in which it is the prin-
 cipal Muscle. In inspiration it is stretched out
 plain; in expiration it grows flabby. Its motion
 seems to be a kind of mixt motion, but rather
 animal than natural; for though we move it in
 our sleep, and so it may seem natural, yet seeing
 when awake we can stop, slacken or hasten its mo-
 tion

tion as we please, it seems to be voluntary or animal.

And thus much of the parts containing, now to the parts contained.

CHAP. IV.

Of the Pericardium, and the Humour contained in it.

THE parts contained are either *Viscera* or *Vasa*, Bowels or Vessels.

The Bowels are the Heart and Lungs. But the Heart being inclosed in a membranous cover called *Pericardium*, we will first treat of it, in this Chapter.

It is called *Pericardium* because it is placed *æi* Its deno-
in *æi* *æi* about the Heart. It is called also *Cap-* mination.
sula cordis, the Heart-case, and *Evolutum*, the
Cover, &c. It is membranous and encompasseth
the whole Heart, whose shape it therefore resem-
bles, but is larger, both to grant a free motion
to the Heart, and to contain its proper liquor.

It springs at the Basis of the Heart from the *Origine*,
outer common Coats (that are borrowed of the
Pleura) of those Vessels that enter into the
Heart. Whence it has *five* holes according to *Holes*.
the number of Vessels that go in or out of the
Heart. As first one made by the ascending trunk
of the *Cava*, another by the *Vena subclavia*, both
which enter the right Ventricle of the Heart,
from whence there goes out *Vena arteriosa* into

the Lungs, which makes a third hole. A fourth is made by the *Arteria venosa* entring the left Ventricle of the Heart, and a fifth by the *Arteria magna* going out of the same.

Connexion. Its outside adheres to the *Mediaſtinum* by many Fibres, and is continued to it at the baſis of the Heart, where the Veſſels perforate it. Its lower end is knit firmly to the centre or nervous part of the Diaphragm, which (*Bartholin* ſays) is peculiar to men, for in all other Creatures it hangs looſe.

Veſſels. It has Veins below from the *Phrenica*, above from the *Axillares*. Its Arteries are ſo ſmall that they can hardly be diſcover'd. It receives Nerves from the pair commonly called the ſixth. *Bartholin* affirms it to have Lymphaticks alſo; which is very probable, that they may abſorb part of the liquor contained in it, leſt it abound too much, ſeeing it receives continual ſupply: for I am not of opinion that this liquor is ſpued out of the Lympheducts, as *Steno* thinks, but that they rather imbibe it and convey it to the *Ductus thoracicus*.

Its liquor. It contains in it a ſerous liquor, that in healthfull Bodies is a little reddiſh, much like water wherein fleſh has been waſht. It is bred of vapours exhaling out of the Heart, which are ſtopt by this denſe Membrane, and condensed into humour. *Dr. Lower* oppoſing this opinion brings for argument, that if it were collected this way, becauſe it would be continually a gathering, it would ſoon encreaſe ſo much that this *Capſula* could not hold it. But the abovesaid Lympheducts abſorbing what is ſuperfluous, waſh away this objection; which if they did not, his own opinion, that

that it drops out of the Glands seated at the basis of the Heart, would be liable to the same inconvenience. For such destillation would be as continual as this condensation is supposed to be. Naturally it is not in quantity above two spoonfulls. This is that liquor that is supposed to have flown from the Side of our Saviour when the Souldier pierced it with a Spear, for saith the Text (John 19. 34.) *There came forth blood and water.*

The *Pericardium* is some sort of fence to the Heart, but it seems to be chiefly made for the sake of the liquor it contains, which serves for the moistening of the Heart and making it slippery, that it may move more glibly. *Their uses.*

CHAP. V.

Of the Heart, in general, and of its Motion.

THE Heart (in Latine *Cor*, in Greek $\kappa\acute{\omicron}\rho$ or $\kappa\acute{\omicron}\rho\alpha\varsigma$ à $\kappa\acute{\omicron}\omega$, to burn, because it is the source of vital heat) is the principal Bowel of the whole Body, which no perfect Animal does want, nor can long survive its wounds. Vital spirit and natural heat are communicated from it to all the parts of the Body, though perhaps not so much owing to its substance as to the fermentation of the humours in it; as shall be discoursed hereafter.

It is seated in the middle of the Breast, encompassed with the *Pericardium* and *Mediastinum*, its lower

lower tip or *Mucro* bending a little to the left side. Neither its *Mucro* nor sides are knit to any place, but it hangs loose in its case, only suspended by the Vessels that go in and out of its upper part or basis. Its situation in Beasts that feed upon Grass is near the middle of the whole Body, reckoning from the Head to the Tail; but in Man (and most carnivorous Animals) it is nearer the Head; whereof the learned Dr. *Lower* gives an ingenious reason. "Seeing, says he, the trajection
 "and distribution of the Blood depends wholly
 "on the *Systole* of the Heart, and that its liquor
 "is not driven of its own nature so readily into
 "the upper parts as into vessels even with it, or
 "downwards into those under it: if the situation
 "of the Heart had been further from the Head, it
 "must needs either have been made stronger to
 "cast out its liquor with greater force; or else
 "the Head would want its due proportion of
 "Blood. But in Animals that have a longer
 "Neck, and which is extended towards their food
 "as it were, the Heart is seated as far from the
 "Head as from the other parts; and they find no
 "inconvenience from it, because they feed with
 "their Head for the most part hanging down,
 "and so the Blood, as it has farther to go to
 "their Head than in others, so it goes a plainer
 "and often a steeper way.

Substance.

It has a firm, thick, dense substance, thinner and softer in the right side, thicker and more dense in the left, but most compact and hard at its tip; only on the left side of the tip it is thin, as consisting mostly of the concurrence of the inner and outer Membrane. Its *Parenchyma* is for the greatest part made up of musculary Fibres so
 that

that it self may truly be reputed a Muscle.

Its Fibres are a few of them streight, but far more oblique. Both are inserted into a Tendon that is spread over its basis under the Auricles. Part of which Tendon at the egress of the *Aorta* in some Creatures becomes bony, as in a Stag, &c. On the outer superficies of the right Ventricle there run a few slender Fibres streight upwards and are terminated in its basis. In which also terminate the oblique ones next under these, ascending from the left side towards the right, spiral-wise. The Fibres that lie under these, go clean contrary. For they arise every where from the right side of the Heart, whence being carried obliquely towards the left, and having embraced each Ventricle of the Heart, they rise to the basis of the left side spiral-wise as the other. But they run not all of them the whole length from the basis to the cone; for then would the Heart be as broad or thick at the lower end as the upper: but some reach not above half way, others a little further, &c. and some to the very *Apex*. The Fibres of the left Ventricle differ not from those of the right as to kind, only they are considerably stronger. Which they are for this reason, that whereas the right Ventricle only promotes the circulation of the blood through the Lungs, the left must cast it forth with that force as that it may circulate through the whole Body.

The curious Reader may find a most accurate description of these Fibres in Dr. *Lower's* treatise *de Corde*, whither I refer him; for, to insist too long on such minute similar parts, would not be suitable to this Epitome of Anatomy. Though
by

by a view of those Figures that I have borrowed of him, their structure may be pretty plainly apprehended.

Figure.

Its shape is like a Boy's Top (save that it is flattish behind) or a Pyramid turn'd topsy turvy; whence it is divided into its basis, which is its broader part and upper; and into its cone or *apex*, or narrower and lower part, which ends in a tip or *micro*.

Bigness.

It is bigger in Men than in other Creatures, considering the proportion of their Bodies. It is lesser but more dense in hot and bold Men, than in the cold and cowardly. In adult persons it is commonly six fingers breadth long, and four broad at the basis.

Coat.

Outwardly it is cover'd with a proper Coat, which is thin, but strong and dense, and very hard to separate from it; it is the same with the outer Coat of the great Artery, as that which cloaths the Ventricle on the inside is continued and common with that thin skin that covers the inside of the Arteries like a *Cuticula*: and hence 'tis likely (says *Diemerbroeck*) that the Arteries borrow these Coats of the Heart, as the Nerves borrow their two Tunics from the *Pia* and *Dura mater* of the Brain. Upon this Membrane that invests the Heart, there grows some hard fat about the basis, which serves to moisten it.

Vessels.

It is not nourished by the blood or nutritious juice received into its Ventricle, but by Vessels running through its *Parenchyma*.

Arteries.

Its Arteries are two, springing out of the *Aorta* before it pass out of the *Pericardium*, and are called *Coronaria*, because their trunks do not presently

presently sink into the *Parenchyma* of the Heart, but fetching a circuit on its surface the better to branch out themselves towards its cone, they encompass its basis. And though at their rise they turn one on one side and t'other on the other of the Heart, yet at their ends they meet again and inosculate one with the other : so that if one inject any liquor into one, it will run into the other.

It has also two *Veins* called *Coronaria* which en- *Veins.* compass its basis in like manner, and communicate one with the other. These receive and carry back the Arterial blood that remains from the nutrition of the Heart, and refund it into the *Cava.*

Nerves it has from the sixth pair (*Dr. Willis's Nerves.* eighth) which passing between the *Arteria pulmonalis* and the *Aorta* do send forth divers twigs on each side into the *Auricula*, and then are branched out into the substance of the Heart. *Dr. Lower* says they are manifestly apparent over all the outer superficies of the Heart of a Calf or other Animal newly brought forth.

Great controverſie hath been and ſtill is about *The motion* the motion of the Heart, whether it depend *of the* on the influx of the animal ſpirits, or on the dilata- *Heart.* tion, ebullition, or accenſion of the blood in its Ventracles, or partly on one, partly on the other. Plauſible Arguments are produced on every ſide, but ſuch as rather tend to ſhew the ſhortneſs and inſufficiency of the contrary opinions to ſolve this *Phanomenon*, than pretend to demonſtrate any certain reaſon of it. That the immediate inſtruments of its motion are its Fibres,
none

none can doubt ; but what sets these Fibres on work is all the question. That it cannot be the Animal spirits conveyed by the Nerves (*only*) is apparent, *first*, because the Heart moves in the *Embryo* before either Brain or Nerve are so perfectly formed, that the Animal spirits can be elaborated out of the Blood by the former, or transmitted to the Heart by the latter : yea seeing they are made of Arterial blood, that must be sent to the Brain by the pulsation of the Heart before they can be generated. And *secondly*, because those muscular motions that depend on the influx of the Animal spirits, are voluntary, which this of the Heart is not, for we can neither stop it nor hasten it at our pleasure. *Lastly*, because the Heart of living *Fetus*'s (as of young Puppies) and of Eels, being cut out of the Body and from all the Nerves by which any Animal spirits should flow into it, will continue beating as long as 'tis warm : yea when it has ceas'd beating, if one throw warm blood or but warm water upon it, it will recover some kind of pulsation again. Which may serve also to convict the second opinion of error ; for if its motion depended only on the dilatation of the blood, it would cease as soon as the blood flows no longer into its Ventricles.

And as to ebullition or accension, Dr. *Lower*'s experiment, or his observation, are a sufficient confutation of their being the reason of this pulsation. His *experiment* is this : " He drew out of the *Jugular* vein of a Dog about half of his blood away, injecting by turns into the *Cervical* vein a like quantity of Beer mixt with a little Wine ; and this he repeated alternately so often, till

" instead

“instead of blood there flow’d out of the Vein
“only a paler tincture like water wherein Flesh
“had been wash’d, or Claret diluted with very
“much Water; and yet the Heart in the mean
“time remitted but a little of its former pulsation.
“on. . . . His *observation*, which he had from
a Physician worthy of credit, is this: “A Youth
“about sixteen years old, continuing bleeding for
“two days together, his friends and those that
“waited on him gave him good store of Broth to
“keep up and recruit his Spirits; which swallowing
“down greedily, his bleeding was now
“and then encreas’d thereby, so that at length
“having poured forth almost the whole mass of
“his blood, that which now run out was dilute
“and pale, neither of the nature nor colour of
“blood, but liker the Broth he had drunk so
“much of: And this kind of flux continued a day
“or two, (the Heart the mean while retaining
“its pulsation) till at length being stopt, the
“Youth was restored by degrees to entire
“health, and grew to a robust and lusty Fellow.]
This experiment and observation I say do make it
apparent, the motion of the Heart depends not
on the ebullition or accension of the blood, for
then when in the first the Beer and Wine, in
the second the Broth flow’d into its Ventricks instead
of Blood, its motion must either have been more
notably alter’d, or rather have quite ceas’d,
these liquors being so far distant from the nature
of blood, especially the Broth.

And lastly, that this motion is not caused
partly by the influx of the animal spirits, and
partly by the ebullition or accension of the
blood, may be evinced by the Arguments produced

duced against each opinion apart : and yet if a reason could be given , this seems the most probable. Namely , that the blood destilling into the Ventricles of the Heart , is in them accended and rarefied, and wanting more room expands or bears against their Sides : and then the *Parenchyma* of the Heart being molested by that expansion , calls in the Animal spirits for help, which coming in in convenient plenty contract the muscular Fibres that make up the *Parenchyma* of the Heart, and so by straitning its Ventricles drive forth the blood contained in them into the Arteries. But we had rather ingenuously confess our ignorance of the reason of so admirable an action, and profess with Dr. *Lower* that it is too hard for Man to conceive of, and that it is the prerogative of God only , who searcheth the secrets of the Heart , to know the reason of its motion also.

CHAP.

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CHAP. VI.

Of the Pulse, and the circulation of the Blood.

THE motion of the Heart is called in Greek *The Pulse*. *συνεσις*, in Latine *Pulsus*, pulse or beating. And this is performed by *Diastole*, or Dilatation, in which it receives Blood into its Ventricles; and *Systole*, or Contraction, by which it expells it.

Contraction being the proper motion of a *Systole* Muscle, the *Systole* is the proper motion of the Heart, and the *Diastole* is but a ceasing or restitution from that motion. For in the *Diastole* the Fibres of the Heart are relaxed, so that the Blood destills down into its Ventricles out of the Veins, whereby when they are filled and in some measure distended, the Fibres both streight and oblique begin to contract themselves, and compress or straiten the Cavities of the Ventricles, and also draw up the cone nearer its basis, whereby the Heart becomes rounder and harder, and the Blood is expelled with force out of the Ventricles into the Arteries; which motion is called the *Systole*. But why the Heart should keep such stated turns of *Systole* and *Diastole*, and continue them for (may be) fourscore years together, *that* (as we said above) we cannot conceive the reason of, but admire the wisdom and power of the Creator, in beginning and continuing such a motion.

Now seeing by this continual reciprocation of *the circulation of the blood*.

R

the Pulse there is a constant expulsion of Blood from the Heart ; there must needs be a continual influx of Blood into the Heart out of the *Cava*. And seeing the *Cava* from whence the supply is, is never drawn dry, and on the other hand seeing the Arteries that receive the Blood continually from the Heart, are not unduly swell'd with it, it necessarily follows that this motion proceeds circularly, viz. that the Blood is continually driven out of the Heart into the Arteries, out of these into the Veins and parts to be nourished, then from the lesser Veins returns to the *Cava*, and so at length to the Heart again. The invention of which circulation is owing to our Countryman Dr. *Harvey*, and may be prov'd invincibly by these reasons.

1. The great quantity of Blood that is driven out of the Heart into the Arteries at every Pulse. For though the Ancients who knew not this circulation, imagin'd that only a drop or two were expelled by every *Systole*, which they were necessitated to suppose, to avoid the great distension that the Arteries must be liable to, if any considerable quantity issued into them ; yet it is certain and demonstrable that there must needs an ounce or more be driven into them each time. For (taking it for granted that there is no other way for any liquor to pass from the Stomach to the Kidneys but through the Heart, along with the Blood) seeing if some Men at some times drink three pints of Drink, they shall piss it out again in half an hour, yea more of *Tunbridge Waters* in that space ; and seeing secondly, that there is commonly as much Blood as *Serum* that flows to the Kidneys (the Blood returning back by

by the Emulgent veins) it is clear that by the two Emulgents (which are none of the largest Arteries) there must pass in half an hours time six pounds of liquor , all which must come from the Heart ; and how much more then may we conceive to be driven through all the other Arteries that run through the whole Body ? This is more accurately evinced by Dr. Lower's experiment, which is this : " I cut asunder (says he) " both *Cervical* arteries in a large Dog, and at " the same time through an hole made in the left " side of his Breast over against the Heart, I com- " prest the trunk of the *Aorta* below the Heart " with my finger, to hinder any Blood from de- " scending by it ; and lastly I took care also to " straiten the *Brachial* arteries under the *Axilla*, " by which means almost all the Blood was driven " out of the Heart through the *Cervicals* (besides " that which was sent into the *Vertebrals*) and " which is wonderfull to be related, within the " twentieth part of an hour the whole mass issued " out ; so that it is not to be denied but that it " all past through the Heart in that space.] And though it may be granted that amidst such wounds and tortures the Heart does beat somewhat quicker in such a case than at other times ; yet the same thing is partly evident from wounds in the Limbs when some notable Artery is cut asunder, for 'tis strange in how small a time a Man will bleed to death even at that one Artery. Yea we may give a great guess how much Blood is sent out at every Pulse, even from the ordinary opening of one *Vein* in the Arm, from whence a notable quantity of Blood will issue in a short time ; how much then may we suppose would flow out of

all the Veins, if they were opened at one time ? Seeing then 'tis evident that so great a quantity of Blood is expelled out of the Heart at every *Systole*, and that for all that the Arteries are not unduly distended nor any part swell'd by it, neither yet the *Cava* and other Veins emptied, 'tis certain that the Blood that is driven into the Arteries flows back to the Heart by the Veins, in a constant circulation.

2. A second Argument to prove it, may be taken from the Valves in the Veins, which are so framed that Blood may freely flow through them out of the lesser Veins into the greater, (and so into the *Cava*) but not on the contrary out of the greater into the less. Yea if one blow into the *Cava* through a Pipe, there will no wind pass into the smaller Veins ; but on the contrary, if you blow up the lesser Veins, the wind will readily pass to the larger and so to the *Cava*.

3. And lastly, The same thing is most clear by the Ligature in blood-letting. For whether you let blood in the Arm or Foot, you always tie the Fillet above where you intend to make the Orifice, and then the Vein below the Ligature will presently fill and grow tumid, but above it will fall and almost disappear. Which must needs be from hence, for that the Blood being driven along the Arteries towards the extreme parts, returns by the Veins and ascends upwards, which coming to the Ligature and being stoppt there, swells the Vein below the Ligature, and spurts out as soon as the Orifice is made: but when the Fillet is loosed again, the Blood flows no longer out thereat, but holds on its wonted channel, the Vein, and the Orifice closes up again.

Having

Having sufficiently demonstrated the circulation of the Blood we will shew two things further, first, how the Blood passes out of the Arteries into the Veins, and secondly in how long a time the whole mass of Blood may be supposed to pass through the Heart in its ordinary circulation.

As to the *first*, it was the opinion of *Riolanus* that the Blood circulated only through the larger Vessels, by anastomoses or inosculation of the Veins with the Arteries, and that that which run into the smaller, was all spent on the nutrition of the parts. But it is clear that there must be a circulation even in the smallest, from the great quantity of Blood that will flow out of the least Artery in the Hand or Foot, when it is cut; which it were very absurd to imagine to be all spent on the nourishment of the respective part. Now there are but two ways whereby the Blood can be supposed to pass out of the Arteries into the Veins, *viz.* either by the former opening into the latter by inosculation, or else by the Capillary arteries letting out their Blood into the pores of the substance of the parts, on whose nutrition part is spent, and the remainder imbibed by the gaping mouths of the Capillary veins. And it seems necessary to admit both these ways; this *latter*, because if part of the Arterial blood did not issue into the substance of the parts, they could not be nourished by it, for while it is in the vessels it may add warmth indeed to the parts through which it flows, but cannot nourish them, seeing even the vessels themselves are not nourished by that stream of Blood that glides along their Cavity, but by Capillaries running through their Coats; and if the Blood be driven into the

R 3 substance

substance of the parts, and that in a greater quantity than suffices for their nourishment (as was just now shewn) what is superfluous must needs enter the mouths of the Capillary veins, from which it goes forward to the larger and so to the Heart : But seeing this way of transfusing the Blood through the substance of the parts answers not to that hasty circulation of the Bloud we above demonstrated ; it is necessary also to admit of the *former* way, namely anastomoses, in which the Veins are continued to the Arteries, and that not only in their larger branches (as that notable one of the Splenick artery with the Splenick vein) but also in their smaller twigs in the extreme parts.

And *secondly* as to the space of time in which the whole mass of Bloud may ordinarily circulate through the Heart, it is probably much shorter than many have imagined. For supposing that the Heart makes two thousand pulses an hour (which is the least number any speak of, and some have told twice as many) and that at every pulse there is expelled an ounce of Bloud (which we may well suppose, seeing the Ventricles are wide enough to contain two ounces, and that it is probable both that they are filled near full in the *Diafole*, and that they are near if not quite emptied by the strong constriction of the Heart in the *Systole*) seeing the whole mass usually exceeds not four and twenty pound, it will be circulated six or seven times over through the Heart in the space of an hour. And by so much the oftener, by how much the Bloud comes short of the supposed quantity, or the pulse either naturally, or by a Feyer or violent motion is rendred more frequent.

quent. By which quick motion the Bloud it self is kept from coagulation and putrefaction, and the parts are cherished with vital heat, which heat of the parts is much according to the slowness or rapidness of the circulation; so when we sit still and the pulse is slow or rare, we grow cold, but when upon running or any violent exercise the pulse becomes more frequent and quick, we become hot.

CHAP. VII.

How Bloud is made of Chyle, of its Colour, and whether the Body be nourished by it.

ACCORDING to Dr. Harvey's observations there appears in an *Embryo* a *punctum saliens*, or red beating speck, which is Bloud, before any the least lineament of the Heart. So that whatever instrument of sanguification the Heart may appear to be afterwards, it contributes nothing to the elaborating of the first Bloud; but it seems rather to be made for the Bloud's sake to transmit it to all the parts of the *Embryo* or *Fetus*, than the Bloud to be made by it. But it must be confest that things proceed in the grown *Fetus* far otherwise than they do in the first formation. For the parts of an *Embryo* are nourished and encreased before it have a stomach to concoct any thing, and yet in a perfect *Fetus* none can deny that the Stomach does concoct and prepare nourishment for it: so it moves before the Brain is formed so perfectly

as to be able to elaborate Animal spirits; and yet after it is perfected, every one knows that the Brain does elaborate such spirits, as being sent into all the parts of the Body by the Nerves enable them to move. In like manner though there be Blood in the *Embryo* before the Heart be formed, yet after it is perfected, nothing will hinder but it may at least contribute something to sanguification.

We will suppose then, that as all the other parts are formed by the *Vis plastica* or generative faculty of the (first) vegetative and (then) animal Soul, seated in the *Ovum*, but as soon as they are perfected and the *Fetus* excluded, are nourished by the blood; so the blood itself being at first made in like manner, as soon as the Veins, Heart and Arteries are completed so as it can circulate by them, may, not improperly, be said to be nourished by the Chyle, the Heart assisting the assimilation of the one into the other. And this is done in this manner. The Chyle ascending by the *Ductus thoracicus* (as was described Book 1. Chap. 10.) and flowing into the Subclavian vein, together with the returning venal blood is poured into the right ventricle of the Heart in its *Diastole* or Relaxation, then by its *Systole* or Contraction it is driven out from thence into the Lungs, from whence it ascends again into the left ventricle of the Heart, out of which it is expelled through the *Aorta*, and passing along with the blood through the Arteries of the whole Body, returns again with it by the Veins to the Heart. For it undergoes many circulations before it can be assimilated to the blood. Which is evident, both because it is the Chyle (but little alter'd)

How chyle
is turn'd
into blood.

alter'd) that is separated in the *Placenta uteri* for the nourishment of the *Fœtus*, and in the Breasts for the Infant to suck, in the form of Milk; and also from hence, that if one be let blood four or five hours (or later) after a full meal, there will a great quantity of the milky Chyle it self swim atop the coagulated Blood. But every time the new infused Chyle passes through the Heart with the Blood, the particles of the one are more intimately mixed with those of the other in its Ventricles, and the vital spirit and other active principles of the blood work upon the Chyle; which being full of salt, sulphur and spirit, as soon as its *Compages* is loosened by its fermentation with the Blood in the ventricles of the Heart (especially, but also in the Arteries) these principles having obtained the liberty of motion do readily associate themselves, and are assimilated with such parts of the Blood as are of a like and suitable nature. Now whether this alteration that happens to the Chyle, especially in the Heart, should be said to be by fermentation, or accension, or by what other action, is a thing not yet (nor likely to be) agreed upon, it is so full of difficulty. But it seems to be by fermentation, from the considerable heat observable in the Arterial blood; and if there be any thing of accension, that seems to proceed, not from any part inherent either in the Blood or Chyle, nor to be effected so much in the Heart and Arteries, as in the Lungs, whiles the Blood passes through their *Parenchyma* out of the *Vena arteriosa* into the *Arteria venosa*, and is inspirited or impregnated with nitrous air drawn into them by inspiration. Which will be more evident by what follows.

Why

The colour
of the
blood.

Why the Blood should be of a red colour rather than any other, no reason can be given but the will of the Creatour, though some attribute it to the Heart, others to the mixture of salt and subacid juices with sulphureous; even as the Oyl of Vitriol being poured upon Conserve of Roses, or other thing that is of a *palish* red (if it contain any thing of sulphur) makes it of a most *deep* red. We will not spend time to shew in how many respects this similitude falls short of explaining the reason of the *Phænomenon*, but shall content our selves with inquiring from whence the difference of colour arises between the Venal and Arterial blood. Every one knows that Blood let out of a Vein into a Porringer, is indeed of a florid scarlet colour in its surface, but all that coagulates is of a dark red colour from the superficies to the bottom, and of such a colour it appears as it streams out of the Orifice of the Vein. But if an Artery be cut, the stream then looks of a far brighter colour, like the superficies of the Venal blood when it is congealed in a Porringer. Now the Arterial blood receives not this florid colour in the Heart but in the Lungs. For if it receiv'd it in the Heart, then might the right Ventricle be supposed to give it as well as the left: but that it does not do so, is clear by this experiment of Dr. *Lower's*. If you open the *Vena arteriosa* which receives the Blood out of the right Ventricle, the Blood differs nothing in colour from the Venal, but its curdled part looks every whit as black. But if one open the *Arteria venosa* as it is entring into the left Ventricle, it has the perfect colour of Arterial blood; which shews,

shews, that as it owes not that colour to the left Ventricle any more than to the right, (being not yet arriv'd at it) so it must receive that alteration of colour in the Lungs, in which the nitrous air being diffused through all the particles of the Blood is intimately mixed with it, and (if you will) accends it. For if there be any such thing as a *Flamma vitalis* (properly so called) in Animals, though the Blood be so it instead of the Oyl or other matter whereon it feeds, yet it oweth the continuance of its burning to the Air, without the continued inspiration of which the Animal cannot live, but instantly dies, even as a Candle is presently extinguished if you put it in a close place where the air cannot come to it, or by some Engine be suckt from it. But this by the bye. For I must confess that (notwithstanding the plausibleness of the opinion) this alteration of the colour of the Blood by the Air in the Lungs, is no sufficient argument to prove any such vital flame, seeing the Arterial blood being extravasated, retains its florid colour, when no doubt if there ever was any accension, the flame is extinguished. But this scarlet colour is meerly from the mixture of the particles of the Air with the Blood, from which it transpires, in a great measure, through the pores of the Skin, while the Blood circulates in the habit of the Body out of the Arteries into the Veins, whence the Venous blood becomes so much darker in colour than the Arterial. And yet the Venous blood it self when extravasated appears of a scarlet dye in its surface, which is meerly from its being exposed to the Air; for if one turn the congealed Blood in a Porringer upside down, the bottom which

at

at the turning is blackish, will in a little while turn red.

Whether
the body be
nourish'd
by blood.

Though we have confessed that the Chyle does circulate through the Body several times before it be perfectly assimilated to the Blood; yet we do not think that it passes into the nourishment of the parts in the form of Chyle. And therefore when speaking of the nutrition of the *Fetus* in the Womb (Book 1. Chap. 33.) we often mentioned a nutritious juice (which was Chyle a little alter'd) we did not call it so with respect to the solid parts of the *Fetus*, but to the Blood it self whose *Pabulum* or nourishment it is, as soon as the Umbilical vein is formed, as the Blood is of the Body. For as to the increase of the first delineated parts of an imperfect *Embryo*, that is far different from ordinary nutrition.

The Blood then consisting of particles of a different nature, each particle passes into the nourishment of that part which is of the same nature. So the salt and sulphureous particles being equally mixt, are agglutinated and assimilated to the fleshy or musculous parts; the oily and sulphureous to the Fat; the salt and tartareous to the Bones, &c. Now this is not done by any election or attraction of the parts, as if they pick'd and choos'd (with a kind of discretion) such particles of the Blood as are suitable to their own nature: For the mass of Blood is equally and indifferently carried to all the parts: But there is that diversity of figure both in the several particles of the Blood and in the pores of each part, that in the circulation through the habit of the Body some stick in these, and others in those, where

where they are fasten'd and united to the substance of the respective parts; and those which through their peculiar figure are unapt to adhere to one or other, return again to the Veins and so to the Heart, where they receive some new alteration. So that as *the Life of the Flesh is in the Blood* (according to *Levis. 17. 11.*) so has it its vital heat and nourishment from it also.

CHAP. VIII.

Of the parts of the Heart, viz. the Auriculæ, the Ventracles and the Septum that divideth them.

HAVING treated of the Heart in general, and of its Action, &c. we now come to discourse *in specie* of the parts which it is compounded of, viz. its two *Auricula*, two Ventracles and the *Septum*.

The *Auricula* or Ears of the Heart are so called from some similitude of shape they have with those of the Head; for they rise from a long basis, upon the basis of the Heart, and end in an obtuse point, making an obtuse triangle. They are as it were two appendages of the Heart, seated at its basis over the Ventracles. They are of the same fabrick and use, being both Muscles, and made up of the same order of Fibres, which are carried into opposite Tendons, whereof that at the basis of the Heart is common to it and these *Auricula*, and the other runs along their upper part.

part. The right is larger and softer, the left is less, but more firm. Their superficies is smooth when they are filled; but when empty, it is wrinkled, and the left more than the right. When they are cut open, there appear in their Cavity many fleshy columns running from the upper to the lower Tendon, and betwixt them there are pretty deep Ditches or long Cavities, but fewer in the right than the left.

Their motion.

They are dilated and contracted in like manner as the Heart, but at different times: for the *Systole* of the Ventricles is at the same time with the *Diafsole* of the *Auricula*; and on the contrary, the *Systole* of the *Auricula* with the *Diafsole* of the Ventricles. So that the *Auricula* are a receiving their Blood from the Veins, while the Ventricles are expelling theirs into the Arteries; and when the Ventricles are relaxed and empty in their *Diafsole*, the Auricles force their Blood into them by their *Systole*.

Use.

They serve to receive the Venal blood immediately out of the *Vena cava*, and *Pulmonalis*, and to measure it as it were into the Ventricles. Whither that they may expell it with the greater force, the internal Fibres or Columns of their cavity arising from their root where they are joined to the basis of the Heart, reach directly outwards towards the *Vena cava*, and *Pulmonaris*, and in the *Systole* of the *Auricula* grasp the Blood contained in their cavity like so many fingers, and squeeze it into the Ventricles whilst they are relaxed in their *Diafsole*.

The ventricles.

The Heart hath two Cavities, called *Ventricles*, whereinto it receives the Blood from its two Auricles, and out of which it expels it into the *Arteria*

Arteria pulmonaris and *Aorta*. The right is wider and not exactly round but almost semicircular, nor reacheth down to the *Mucro* or tip of the Heart; the left is narrower but rounder and longer, reaching down to the very tip. Now though the outside of the Heart be smooth, yet these Ventricles are very unequal, having their sides hollowed into divers interstices or furrows, and interwoven with carnous Fibres reaching this way and that way. They are more numerous in Men's Hearts, than in those of any other Animal; though such as are big, as Horses and the like, have them larger. These Fibres or fleshy Columns serve to straiten or constrict the Ventricles, and the clefts or furrows betwixt them help their sides to close more exactly in their *Systole* than they could have done, had they been smooth. The Fibres are more and stronger and the furrows deeper in the left Ventricle than in the right, yea they are also in that side of the *Septum* that makes part of the left, though that side that looks to the right be well nigh smooth. For there was need of greater and stronger constriction in the left than in the right; seeing the right expels the Blood to no greater circuit than through the Lungs, but the left to the extreamest parts of the Body.

They are divided from one another by the *Septum*. *Septum*, or a partition that stands like a Wall betwixt them. It is hollow towards the left Ventricle, and (as was just now said) has such like Fibres and Clefts as the rest of the Cavity; but towards the right it is convex or bunching out, and has but very little inequality. Many have been of opinion that it has some wider pores through

through which part of the Blood does pass immediately out of the right into the left Ventricle; but he that searches for them diligently will find none, unless he first make them with his Probe. And indeed if there were any in grown persons, we may much more suppose them to be in *Fetus*'s in the Womb, in whom are several passages that after the birth are obliterated. But if these were in the *Fetus*, then should Nature have made those two other passages in vain, namely the *Foramen ovale*, whereby the Blood passes out of the *Cava* into the *Vena pulmonaris* as it is entering the left Ventricle; and the *Canalis arteriosus*, which carries the Blood out of the *Arteria pulmonaris* into the *Aorta*. I say if the Blood could have passed out of one Ventricle into the other (without going through the Lungs) by any pores that perforate the *Septum*, these other passages had been superfluous. And therefore we may suppose, that as in grown persons they cannot be found by any Probe or Bristle, so they were not there even while the *Fetus* was in the Womb, seeing there was no occasion for them.

As to the use of the Ventricles, it may be learned partly by what has been discoursed in the three former Chapters, and partly by what shall be said further in the following, wherein we are to describe the Vessels opening into and out of them. Whither also we transfer the treating of their *Valves* that are placed at their Orifices.

CHAP. IX.

Of the Ascending trunk of Vena Cava.

BECAUSE the Vessels contained in the *Thorax* either open into the Heart or run out of it, having finished the description of *It*, we shall discourse next of *them* as appendages to it. But we shall not need to repeat here what we said Book 1. Chap. 10. of the *Ductus chyloferus thoracicus*, that runs up the *Thorax* by the Spine, and opens into the Subclavian vein, but shall desire the Reader to look back thither for the description of it. And now shall only meddle with the Sanguiferous vessels that are four in number, viz. *Vena cava*, *Arteria pulmonaris* (or *Vena arteriosa*) *Vena pulmonaria* (or *Arteria venosa*) and the *Aorta* or *Arteria magna*; and in this Chapter of the first, viz. *Vena cava*.

In the former Book Chap 12. and 13. where *Vena ca-*
we discoursed of the Vessels contained in the *Ab-*
domen, we supposed (with the Galenists) that
both the *Vena porta* and *Cava* had their rise from
the Liver, not dogmatically asserting it, but
supposing it for methods sake. And in Chap. 13.
describing the branches of the *Cava* in the *Abdo-*
men, we found it presently dividing it self (after
its rise out of the upper part of the Liver) into
the *Ascending* and *Descending* trunk; the descrip-
tion of the branches of the *latter* (in the lower
Belly) we there finished; but traced the *Ascen-*
ding trunk no further than its penetrating through
the Midriff up into the *Thorax*, deferring the fur-

S

ther

ther prosecution of it till this place that we come to treat of the Vessels contained in the *Thorax*.

Venæ
phrenicæ.

As it ascends through the Midriff it sends forth a small Sprig on each side, called *Venæ phrenicæ*; these run through the Midriff, the *Mediastinum* and *Pericardium*. If at any time matter gathered in the cavity of the *Thorax* be afterwards discharged by Urine, (which many Physicians have affirmed) it is probable that it is absorbed by the mouths of these Veins gaping in the upper side of the Diaphragm, (upon which such matter must be supposed to fluctuate) whereby it is brought into the *Cava*, and so in the circulation is separated by the Kidneys out of the Emulgent arteries, and descends by the Ureters to the Bladder.

Venæ coronariæ.

From the Diaphragm it passes undivided to the right ventricle of the Heart, but before it enter it, having pierced the *Pericardium* it sends forth sometimes one, sometimes two twigs called *Venæ coronariæ*, which compassing the basis of the Heart bring back into the *Cava* the Blood that is superfluous from its nutrition. As these open into the *Cava* there is a Valve placed, which permits the Blood to return by them into the *Cava*, but hinders any to pass out of the *Cava* into them.

Before this trunk of *Venæ cava* open into the Ventricle it is joined to that other trunk that descends from the *Clavicle*, (though for method's sake we must consider that as a continuation of this, by and by) and both of them discharge the Blood contained in them by one mouth into the said Ventricle. As they are going to join, there comes a Tubercle or Protuberance betwixt them, that hinders the one from opening into the other
in a

in a direct line, but makes them both go obliquely towards the left hand as they enter the *Auricula*; without which provision, that Blood that is a descending from the *Clavicula* would have fallen so full on that which is ascending by this trunk of the *Cava*, we have been a describing, as must have made it either to stagnate (if not regurgitate) or however would have retarded its motion.

Now immediately below this protuberance, out of the united trunk there goeth a passage along the basis of the Heart to the *Vena pulmonaria* in *Fetus*'s in the Womb, which as soon as they are born closes up and becomes obliterate. The reason of this passage of the Blood in them is, because their Lungs having either none or but a very obscure and imperfect motion, the Blood does but little of it pass through them, but a good part of it through this *Foramen* out of the *Cava* into the *Vena pulmonaria* just as it is entering into the left Ventricle, into which this Blood is discharged together with that little that is returning by the said *Vena pulmonaria* from the nutrition of the Lungs. For though there be expelled out of the right Ventricle a pretty quantity of Blood at every pulse into the *Arteria pulmonalis*, yet there is but a little of it that goes to the Lungs (though all do in adult persons, that it may be there impregnated with Air) but the greatest part by a Pipe called *Canalis arteriosus* runs into the *Aorta*, which Pipe does degenerate into a Ligament after the *Fetus* is born. So that the *Fetus* in the Womb liveth after the manner of Fish or other Creatures that have no Lungs and but one ventricle of the Heart; for there is but very little of its Blood that passeth any more than

one of its Ventricles in one circulation, that which circulateth through one missing the other. But to return:

The united trunk of the *Cava* opens by one large Orifice into the right ventricle of the Heart, into which is poured all the Blood that returns from all the parts of the Body (except the Lungs) in its circulation. And lest in the *Systole* or constriction of the Heart, the Blood should be expelled the same way that it comes in by; at the Orifice of the *Cava* there grows a membranous circle, which is cleft into three membranous Valves, looking inwards, called *Tricuspidæ* (or three-pointed) which permit the Blood to come in, but not to go out. And this office these Valves perform in this manner, (as is most ingeniously described by Dr. Lower.) Out of the sides of the right Ventricle there grow certain *Papilla* or round and long Caruncles (called before, fleshy Columns) from whose top there proceed certain tendinous Fibres that are knit to these membranous Valves. Now these Membranes encompass the orifice of the *Cava* round about, so that whereas the *Mucro* or tip of the Heart is in every *Systole* drawn up towards the basis, the *Papilla* being also moved upwards do slacken their Fibres (like Bridle-reins) whereby it comes to pass that the Membranes (or Valves) also, to which they are tied, hanging loose are driven upwards (like sails filled with wind) by the Blood that is squeezed in every *Systole* of the Heart, and thereby they shut this inlet into the Heart so closely, that not a drop of liquor can flow back again into the *Auricula* or *Cava*, but is expelled all into the *Arteria pulmonalis* that is now open: But, as in every

every *Systole* of the Heart (its tip being brought nearer its basis) the *Papilla* do much relax their Fibres; so in the *Diastole* the tip receding from the basis again does also draw down the *Papilla* and their Fibres with it: whence it comes to pass that the Membranes or Valves being also drawn down do presently unshut this Orifice, and open the door as it were for more Blood to come in, what came in before being expelled in the last *Systole*.

The united trunks of the *Cava* discharging themselves thus into the right Ventricle, that which ascends towards the *Clavicula* (for so we must consider it for orders sake, though in truth it descends from thence) as soon as it is gone out of the *Pericardium*, sendeth forth a notable branch called *Vena sine pari*, (or *ἀζυγῶν*) because it is but one, having no fellow.

It ariseth out of the hinder part of the *Cava*, Vena sine pari. but more towards the right hand, and descends through the right side of the cavity of the *Thorax*. After its beginning, which is betwixt the fourth and fifth *vertebra* of the Breast, it bends a little forward toward the right hand, till it be descended as far as the eighth or ninth *vertebra*, where it begins just to keep the middle. It sends forth on each side Intercoastal branches to the Interstices of the eight lowest Ribs; and at the eighth Rib it is divided into two branches: One whereof, being the larger, descends toward the *left hand* betwixt the processes of the Diaphragm, and is inserted sometimes into the *Cava* above or below the Emulgent, but oftner into the Emulgent it self: The other being the *right* is joined also to the *Cava*, commonly a little above the Emulgent, but seldom into the Emulgent it self.

It was formerly held, before the circulation of the Blood was found out, that in an *Empyema* of the *Thorax*, the matter was absorbed by the mouths of this Vein, and carried directly to the Emulgent veins, where it was separated with the *Serum* by the Kidneys. But seeing the Blood does indeed ascend from the Emulgents by this Vein, and that at its insertion into them there is commonly a Valve that hinders any thing from issuing out of the *Vena sine pari* into the Emulgent, but permits the contrary; it is certain that if this Vein be at any time an instrument to evacuate such *Pus*, it must first ascend to the *Cava* and pass through the Heart, and so be carried to the Kidneys by the *Aorta* and the Emulgent arteries arising out of it. But though it is difficult to conceive how the mouths of this Vein should open so wide into the cavity of the *Thorax*, as to imbibe slimy roapy *Pus*, and yet not let forth the Blood that is more fluid; so that one would hardly assign this office to it: yet when the *Pus* is collected betwixt the *Pleura* and Intercoastal muscles and the Tumour does not burst, I see not why it may not be supposed that the Intercoastal branches of the *Vena sine pari* do imbibe the matter out of the Tumour, and carry it that way which was just now spoken of. And if ever *Pus* be imbibed out of the cavity of the *Thorax*, because it floats upon the Diaphragm, the *Vena phrenica* are liker to do it than this, as was noted before in this Chapter when we described those Veins. Of this *Vena sine pari* we shall say no more, but that at its rise out of the *Cava* it has a Valve that opens towards the *Cava*, which having sent forth this Vein, ascends on towards the *Clavicula* strengthened and sustained

ed by the *Mediaſtinum* and *Thymus*, and before it is divided into the two *Rami ſubclavii* (ſometimes after) ſends out yet two other ſmall Veins called

The *ſuperiour Intercoſtals*, on each ſide one, each of which has a Valve where it joins to the *Cava*, permitting the influx of the Bloud into it, but hindring its relapſe. Theſe run along the Interſtices or intervals of the three or four uppermoſt Ribs. Yet ſometimes the *Vena ſine pari* ſends twigs to theſe four Interſtices of the Ribs as well as to the eight lower, and then theſe ſuperiour Intercoſtals are wanting. Intercoſtales ſuperiores.

Afterwards the trunk of the *Cava* is divided into two large Veins, one of which goes to the right hand, the other to the left. Theſe while they are within the Breſt are called *Vena ſubclavia*, running along the Channel-bones; but aſſoon as they are gone out of it, *Axillares*. They ſend forth ſeveral branches both upwards and downwards. Sometimes the ſuperiour Intercoſtals juſt now mentioned (though ſeldom) ariſe out of them. Next, the Vena ſubclavia.

Mammaria deſcend from them, (though theſe ſometimes ſpring out of the trunk of the *Cava*; ſo uncertain is the origine of ſome of theſe Veins.) Branches ariſing from them. Theſe ſend forth double branches, Internal and External. The *Internal* run to the griſtly ends of the Ribs and their Intercoſtal ſpaces, and ſome of their twigs alſo are terminated in the glands of the *Mamma*. The *external* paſs down on the outside of the Breſt, and ſend many twigs into the ſaid Glands, and marching further by the ſides of the *Cartilago enſiformis* deſcend out of the *Thorax*, continuing their courſe down the i. Mammaria.

Abdomen, under the streight Muscles thereof, till about the Navel, where it hath been an old Tradition that they inosculate with the *Vena epigastrica*; but this was a mistake, as has been noted more than once already. *Bartholin* says that sometimes there is but one *Mammaria*.

2. *Media-*
stina.

The second Vein that ariseth out of the Subclavian is the *Mediastina*; this sends twigs to the *Mediastinum* (from which it has its name) to the *Pericardium* and to the Gland called *Thymus*. This also sometimes springeth out of the trunk of the *Cava*.

3. *Cervi-*
calis.

The third is *Cervicalis* or *Vertebralis*; this turns backwards towards the *vertebrae* of the Neck, into whose lateral holes it enters by some small twigs, which disperse themselves through the Membrane that invests the marrow contained in these *Vertebrae*; and other twigs it bestows upon the Muscles that lie next upon the *Vertebrae*.

4. *Muscu-*
la inferior.

The fourth is *Muscula inferior*; this is spent upon the lower Muscles of the Neck and the upper of the *Thorax*. It riseth sometimes from the external Jugular.

All these spring from the lower side of the Subclavian veins; but these that follow from the upper. As

5. *Muscu-*
la supe-
rior.

The *Muscula superior*, which is dispersed through the Muscles of the Neck,

6. *Jugula-*
res.

Then the *Jugulars*, which are double, *External* and *Internal*. As they go out of the Subclavians there is placed sometimes one thin Valve, sometimes two; to hinder the return of the Blood out of these into them.

The *External* ascend on the outside of the Neck, and these are they which are opened when any one is let blood in the Neck for any Distem-

per

per of the Head, or Quinzy, &c. They ascend but just under the Skin, and provide for the outward parts of the Neck, Chaps, Head and Face. They make the Temple-veins and the Forehead-vein, both which are wont sometimes to be opened. Yea they send small Capillaries through the sutures of the Skull into the Membranes that cover the Brain.

The *Internal*, in Men, are larger than the *External*. They ascend from the Subclavian by the sides of the Wind-pipe, on which they bestow small twigs. As soon as they are come to the basis of the Skull, they are each divided into two, the greater and less. The greater is carried backwards, and by that hole of the *Os occipitis* by which the sixth pair of Nerves (Dr. Willis's eighth) comes out of the Head, they enter in, and are dispersed through the *Dura mater*, &c. The less enters in by the holes made for the third and fourth pair of Nerves, and is also bestowed on the *Dura mater*, &c.

When the Subclavian veins have sent forth all these branches, they then pass out of the *Thorax*, and begin to be called *Axillar*, of which we shall treat in the fourth Book, Chap. 1.

Into the *Vena subclavia* are inserted also the *Ductus chyloferus thoracicus* (of which in the first Book Chap. 10.) and *Lymphaticus ramus*, which returns the *Lympha* from the Arms, Neck, &c. but sometimes this opens into the Jugular.

CHAP.

CHAP. X.

Of Vena arteriosa, and Arteria venosa.

Vena arteriosa.

THE second vessel in the Breast is called *Arteria pulmonaris*, otherwise *Vena arteriosa*. It is an Artery from its office: for it carrieth Bloud out of the right Ventricle of the Heart to the Lungs. Its Coat is double also like that of other Arteries.

Its valves.

As it riseth out of the right ventricle of the Heart, there stand at its orifice three Membranous Valves looking outwards, called *Semilunares*, because they make as it were a half circle; as also *Sigmoïdes* or *Sigmoïdea*, from the shape of the Greek letter *Sigma*, which of old was of the same figure with an English capital C. In the *Systole* of the Heart they open, and permit the Bloud to issue out of the Ventricle into this Artery; but in the *Diastole* they shut, so that none can return back again.

Branchings in the Lungs.

As soon as it is past out of the *Pericardium*, it bends towards the *Aspera arteria* or Wind-pipe, and is divided into the right and left branch, which applying themselves to the like branches of the *Aspera arteria* do every where accompany them on the under side, and as they run along send out very many twigs on every side, which presently associate with those of the Wind-pipe, and of the *Vena pulmonaris*. And where the small Pipes of the *Aspera arteria* end into the little round Cells (which we shall describe in the Chapter of the Lungs) the twigs of this Artery being

being complicated with those of the Vein do embrace them like a Net. Whence one may guess that the reason why the sanguiferous vessels do so exactly accompany all the branches of the Wind-pipe and its annexed little Bladders, is, that the whole mass of Blood passing this way may be inspired or impregnated with the particles of the nitrous Air. For there is but a very little spent on the nutrition of the Lungs, but the greatest part of it is driven into the small twigs of the *Vena pulmonaria* which inosculate with those of the Artery in all its ramifications.

The third vessel is called *Vena pulmonaria* or *Arteria venosa*; this has but a single Coat as the other Veins have. After it has accompanied the Wind-pipe and *Arteria pulmonaris* in all their branchings in the Lungs, and by its small twigs has received the Blood by *anastomoses* out of the Artery, it unites first into two trunks (*viz.* the right and left) afterwards into one, and opens into the left ventricle of the Heart.

At its orifice there are placed two membranous Valves called *Mitrales*, because when they are joined together they do in some manner resemble a Bishop's Mitre. They are of a stronger texture than those called *Tricuspides* at the orifice of the *Cava* in the right Ventricle; and so are the Fibres that ascend to them from the *Papilla* or fleshy columns, stronger. For seeing the Blood is expelled more impetuously out of the left Ventricle than out of the right, (for the Blood sent out of the one is to circulate only through the Lungs, but that out of the other, through the whole Body) it was convenient that the Valves and Fibres should be stronger, to sustain the violent

lent motion of the Bloud, and hindring it from returning into this Vein again; to direct its course into the *Aorta* whose orifice opens in the *Systole* of the Ventricle.

Just as this *Vena pulmonaria* is entring into the left Ventricle, there is, in a *Fetus* in the Womb, a Pipe called *Foramen ovale* that opens into it coming from the *Cava*, as was noted above. To which we shall here add, that at its orifice into this Vein there is a Valve placed, that hinders any Bloud from returning into the *Foramen* out of the Vein.

And here there is one thing worth noting concerning the pulmonary Artery and Vein, That whereas in all the other Arteries and Veins through the whole Body besides, the Bloud contained in the Arteries is of a bright scarlet colour, and that in the Veins of a black purple; on the contrary, the *Arteria pulmonaris* containeth black purple Bloud, and the Vein scarlet-coloured. The reason whereof was shewn before, Chap. 7. viz. That the scarlet colour of the Bloud is wholly owing to the mixture of Air with it in the Lungs. And therefore that Bloud which the pulmonary Artery brings into the Lungs out of the right ventricle of the Heart, being the Venal bloud that was brought thither from the circulation by the *Cava*, changes not its colour till it passes out of the small twigs of the said Artery into those of the pulmonary Vein, where the airy particles insinuate themselves into it, and so alter its colour.

The pulmonary Vein hath no Valve in it, except that at its opening into the left Ventricle. Of which Dr. *Willis* giveth this reason, That the
Bloud

Bloud within the *Pracordia* may always, because of the *Impetus* of the passions, freely fluctuate and regurgitate both ways, backwards and forwards. And lest the left ventricle of the Heart should at any time be suffocated by the Bloud rushing too impetuously into it, the fleshy Fibres in the root of the Vein (for both this and the *Cava* have such there) by the instinct of Nature contracting themselves invert its course, and make it flow backward towards the Lungs.

CHAP. XI.

Of the great Artery, or Aorta.

THE fourth vessel is the great Artery called *Aorta* (*arcula*, a little Chest) and by way of eminency *Arteria magna*, because it is the greatest Artery of the whole Body, from which all the others (except the pulmonary) are derived.

It springeth out of the left ventricle of the *Its valves.* Heart, and at its rise hath three Valves looking outwards, called *Semilunares*, being altogether like those at the orifice of the *Arteria pulmonaris* in the right Ventricle. These hinder the Bloud from returning out of the great Artery into the Heart again. The orifice of the *Aorta* (or else the Tendon of the Heart that adheres to it) in some Creatures (especially in Harts) does often grow bony ; and sometimes in Men, according to the observations of *Bartholin* and *Ricclanus*.

Assoon

As soon as the *Aorta* is gone out of the Heart, it ascends not in a direct course towards the Head; for if it had, seeing it openeth streight upward out of the Ventricle, it would have poured the Blood in too rapid a stream into the Brain, and the lower parts of the Body would have been defrauded of their due share: but it first bends arch-wise, so that its bowed corner sustains the first *Impetus* of the expelled Blood, and directs the greatest torrent towards its descending trunk, and a lesser quantity passes up by the ascending, being to convey the Arterial blood to fewer and smaller parts.

In a *Fetus* in the Womb there comes a Pipe out of the *Arteria pulmonalis* into the *Aorta*, called *Canalis arteriosus*, which brings out of it the greatest part of the Blood that was expelled out of the right Ventricle; little more passing into the Lungs than may serve for their nourishment: of which we gave the reason before, Chap. 9. After the *Fetus* is born, this *Canalis* degenerates into an impervious Ligament.

Before the *Aorta* come out of the *Pericardium*, it sendeth forth sometimes one, but oftener two small twigs, from each side one, which compass the *basis* of the Heart like a Garland, and send down according to the length of the Heart other twigs: These are called *Coronariae*. When these two twigs have encompassed the *basis* and meet, they inoculate with one another, but not with the Veins. At their rise out of the *Aorta* there is a Valve placed, that permits the Blood to flow out of the great Artery into them, but hinders its reflux.

When

When it hath pierced the *Pericardium*, and bended a little arch-wise backwards, it is divided into two Trunks, whereof the one is called *Truncus ascendens*, the ascending Trunk; the other *descendens*, the descending.

The division of the Aorta.

Of these two, the *descending* is largest, because it ministreth to more parts.

The *ascending* Trunk running up under the *Vena cava* lies upon the Wind-pipe, and is presently divided into two branches, whereof one passeth to the right, the other towards the left Arm: They are called *Rami subclavii*, because they march under the Channel-bones; and as soon as they are gone out of the Breast are called *Axillares*. The right is the larger, and arising higher goes a more direct way towards the Arm; the left is less, and arising lower ascends more obliquely towards the left Arm. They send out several branches both from their *lower* and *upper* side.

The branches of the trunk ascending.
1. Subclavia.

From the *lower* proceeds the superiour *Intercostal*, which runs along the interstices or intervals of the four uppermost Ribs, and sends slips to the neighbouring Muscles and spinal marrow. These sometimes arise from the cervical Arteries, coming out through the holes of the *Vertebra*.

2. Intercostalis superior.

From the *upper* side of each subclavian springs first *Mammaria*, which descends towards the Breasts through the Muscles that fill up the interstices of the cartilages of the true Ribs; and a considerable branch of each descending out of the *Thorax* by the sides of the *Cartilago ensiformis*, run down the *Abdomen* under the *Musculi recti*, spreading there into many twigs: which are said to

3. Mammaria.

to inosculate with the extremities of the like twigs of the epigastrick Artery ascending. But that opinion is so opposite to the circulation of the Blood, that it is impossible to be true. For no Blood can ascend by the *Mammaria*, nor descend by these ascending twigs of the *Epigastrica*.

4. Cervi-
calis.

The next is *Cervicalis* (otherwise called *Vertebralis*) which sendeth slips to the *Vertebra* and Muscles of the Neck, at whose seventh *Vertebra* it enters in by the holes of the transverse processes and pierceth the Membrane that invests the spinal marrow, bestowing twigs both on the Membrane and marrow, and runs up therewith in at the great hole of the *Occiput*, and being enter'd the Skull, both branches (the right and left) join under the marrow, and then are divided into innumerable most small twigs which make wonderful net-like *Plexus* in the *Pia mater* about the *Cerebellum*, and run into the substance of the *Cerebellum* it self; and some of them being united with those of the *Carotides* make part of the very *Rete mirabile*.

5. Muscu-
la.

The third Artery that rises out of the upper side of the subclavian is *Muscula*; this bestows branches on the muscles of the Neck, and sometimes on some of the Arm.

After the *Subclavians* have had all these pairs of Arteries going out of them, they pass out of the *Thorax*, and begin to be called *Axillar*, of which in Book 4. Chap. 2.

Carotides.

At the same place, or very near, where the ascending trunk of the *Aorta* sends out the *Subclavians* side-ways, it ascends directly upwards, divided into two, called *Carotides*, (though the right
some-

sometimes arises from the right Subclavian.) These at their rise are sustained by the *Thymus*, and having bestowed twigs on the *Larynx*, Tongue, the Muscles of the *Os hyoides* and the neighbouring Glands, pass up on each side by the sides of the Wind-pipe to the Jaws with the internal Jugular vein, and there are each subdivided into the external and internal branches.

The *external* is smaller, and is dispersed into all the Muscles of the Cheeks, Fore-head, Temples, Lips; and in general, through all the outer parts of the Head and Face.

The *internal*, which is larger, sends first some more twigs to the *Larynx*, Tongue, &c. as also to the Glands behind the Ears, and the spongy parts of the Palate and Nose. Then it entrenches the upper Jaw, and bestows a small slip on the root of each Tooth (as the external did to the Teeth of the lower Jaw) whereby sharp humours flowing in upon them sometimes cause a very painful Tooth-ach. The remainder of it climbs upon the Skull, being about its *basis* divided into two branches. The *less* and hinder whereof having sent one slip to the inner Muscles of the Neck, and another through the hole of the uppermost *Vertebra* into the Membrane that invests the spinal marrow, ascending further enters the Skull at the hole by which the sixth pair of Nerves (commonly so called) comes out, and creeping along the *Dura mater* ends near its *Sinus*, (which yet some say it enters.) The *larger* branch, tending upwards is carried through the bony channel in the wedge-like bone with a winding duct to the *Sella equina*; at whose *basis*, after it has sent out a twig on each

side into the *Dura mater*, it opens it self into many small slips, which being infolded with those of the cervical Artery (above-mentioned) make the *Rete mirabile*, which is more observable in Beasts than in Men. Yet it is not all spent on the said slips, but perforating the *Dura mater*, it enters the *Pia mater* with two notable branches, which being divided into very small twigs are mingled with those of the cervical Artery, with which they pass out of the Skull and accompany the spinal marrow even to the Loins. Afterwards it sends a small branch through the second hole of the wedge-like Bone with the optick Nerve, out of the Skull, to the Eye. And yet still supplying more twigs to the substance of the Brain and *Pia mater*, and being united with some other twigs of the cervical Artery, it makes the *Plexus chorooides*.

The branches of the trunk descending.

The descending trunk of the *Aorta*, which is larger than the ascending, goes down by the Gullet, to which it cleaveth. And hence is a Man that is hot, so much cooled with a draught of cold drink; for the Gullet being cooled thereby, the Blood in the *Aorta* contiguous to it must needs be cooled likewise.

1. Interco-
stalis in-
ferior.

Before it arrive at the Diaphragm it sends out of its hinder side the inferiour Intercostrals which run along the interstices of eight or nine of the lower Ribs, namely those which the superiour Intercostrals did not supply. They likewise send sprigs by the holes of the *Vertebra* made for the Nerves, to the marrow of the Back, and to the Muscles which rest upon the *Vertebra*. and also to those of the *Thorax*. Sometimes above this and sometimes

sometimes below it, there arises also out of the hinder part of the *Aorta*, an Artery called *Bronchialis*, first found out and so named by *Frederick Ruysch*, which accompanies all the *Bronchia* of the Wind-pipe.

When it comes to the Midriff, there spring out of it the *Phrenica*, one on each side: these running through the Diaphragm, pass up into the *Mediastinum*, and sometimes into the *Pericardium*. 2. Phrenica.

Then having penetrated the Midriff it descends in one trunk to the fifth *vertebra* of the Loins; in which passage it first sendeth forth *Celiaca* which ariseth single, and is so called, because it sendeth twigs to the Stomach. This springeth from the fore-part of the Trunk, at the first *vertebra* of the Loins, and descending under the hollow of the Liver, upon the trunk of the *Vena porta* it is divided into two branches, the right and left. 3. Celiaca.

The right which is smaller, ascending, produces in its upper part the *Gastrica dextra*, that comes to the *Pylorus*, whence *Spigelius* calls it *Pylorica*. And besides, the *Cystica gemella*, which are very small, and are dispersed through the Gall-bladder. And out of its lower side there spring out of it, Its branches.
Gastrica dextra.
Cystica gemella.

1. *Epiplöis dextra*, which runs through the right side of the lower leaf of the Caul and the *Colon* that is annexed to it. Epiplöis dextra.

2. *Intestinalis*, bestowed on the *Duodenum* and beginning of *Jejunum*. Intestinalis.

3. *Gastroepiplöis dextra*, on the bottom and middle of the Stomach, and also on the Caul that is knit to its bottom. Gastroepi-
plöis dex-
tra.

Hepatica.

4. *Hepatica*, which are two small ones : these are spent on the investing membrane of the Liver (for its *Parenchyma* is nourished by the *Porta*) the *Capsula communis*, the Gall-bladder and *Forus bilarinus*.

The remainder of this *right* branch enters the Mesentery with many twigs.

Splénica.

The *left* branch of the *Celiacæ*, which is called *Splénicus* (sometime springing immediately from the *Aorta*) is larger than the right, and as it goeth towards the Spleen it sendeth forth of its

Gastrica
major.

upper side *Gastrica major*, which after it hath bestowed a slip on the higher and middle part of the Stomach, is divided into two others; the first whereof is called *Coronaria stomachica*, which encompasses the upper orifice of the Stomach like a Garland, and sends many twigs to the body of the Ventricle it self. The other is called *Gastrica sinistra*, and this is carried towards the right

Coronaria
stomachi-
ca.Gastrica
sinistra.

hand into the upper part of the Stomach and the *Pylorus*. Out of its *lower* side spring, first *Epiplois postica*, which runs to the lower leaf of the *Omentum*, and the *Colon* annexed to it; secondly *Epiplois sinistra*, which is bestowed on the lower and left side of the *Omentum*.

Epiplo's
postica.Epiplois
sinistra.Vas breve
arterio-
sum.
Gastro-
epiplois si-
nistra.

Just as this splénick branch is entring into the Spleen, there arise out of its upper part *Vas breve arteriosum*, which goeth streight to the left part of the bottom of the Stomach; and the *Gastro-epiplois sinistra*, which being sustained by the upper leaf of the *Omentum* sends some twigs thereto, and also to the left part of the bottom of the Stomach, and to both its fore and hinder sides. Then it enters into the Spleen, whose branchings therein we described in the former Book, Chap. 16. of the Spleen.

All these Arteries spring from the *Cæliaca*, and accompany the Veins of the *Porta* of the like denomination.

The next that arises out of the trunk of the *Aorta* is the upper Mesenterick, which springs from the fore-part of it as the *Cæliack* did. It accompanies the *Vena mesaraica* of the *Porta*, and runs through all the upper part of the Mesentery, and bestows many branches on the Guts *Jejunum*, *Ileum* and that part of *Colon* that lieth in the right Hypochondre.

Immediately below this, about the second vertebra of the Loins, there go out of each side of the descending trunk of the *Aorta* an Emulgent artery, each of which being after its rise divided into two and sometimes three branches, enters the Kidney of its own side. The right springs out of it a little lower than the left. Both are subdivided into innumerable twigs in the *Parenchyma* of the Kidneys, and their Capillaries end in the Glands, wherein the *Serum* that these Arteries bring with the Bloud is separated therefrom, and carried from them by the urinary Siphons into the *Pelvis*, of which more in the former Book, Chap. 17. of the Kidneys.

Next to these arise the *Spermatice* (called *Arteria preparantes*.) These go out of the fore-part of the Trunk very near together (very seldom either of them out of the Emulgents, as the left Spermatick vein does) and the right passes over the trunk of the *Vena cava*. About two fingers breadth from the Emulgents they are each joined with the *Vena preparans* of their own side, and descend with them in *Men* through the process of the *Peritoneum* to the Stones, being divided

ded into two branches a little before they arrive at them, one of which runs under the *Epididymis*, and the other to the *Testis*. In *Women*, when they come near the *Testes*, they are divided also into two branches. one whereof goes to the *Testis*, and the other to the bottom of the Womb.

7. Mesenterica inferior.

Next below the *Spermaticks* springs the lower *Mesenterick* out of the Trunk a little before it is divided into the *Rami iliaci*. This entreth the lower region of the *Mesentery*, and distributes many branches to the left part of the *Colon* and to the streight Gut, and lastly descending to the *Anus*, makes the internal hemorrhoidal Arteries.

8 Lumbares.

Very near to this, out of the Trunk still, arise the *Lumbares*, reckoned four in number. These go out of the backside of the *Aorta*, and are distributed not only to the neighbouring muscles of the Loins, and to the *Peritoneum*, but enter in at the holes of the *vertebra* of the Loins, and run along the Membrane that involves the spinal marrow, and penetrate into the marrow it self.

Besides these some reckon other two, on each side one, called *Muscula superiores*, (which run to the Muscles of the *Abdomen*) unless these be two of the four called *Lumbares*.

Rami iliaci.

When the Trunk is descended as low as the last or fifth *vertebra* of the Loins and the top of *Os sacrum*, it begins to climb upon the *Vena cava*, under which it passed thus far. But as it begins to get upon it, it is divided into two equal branches called *Rami iliaci*, and at its very division there springs out of it *Arteria sacra*, whose small twigs entering in at the holes of *Os sacrum*

crum penetrate into the marrow contained in it.

The Trunk of the descending *Aorta* being divided into the *Rami iliaci*, these are subdivided presently into the *interiour* and *exteriour* branches. *Their branches.*

From the *interiour*, which is less, proceed three others.

First, the inferiour *Muscula* (called otherwise *Glutea*) which is bestowed on the Muscles named *Glutei* that make the Buttocks, and also on the lower end of the Iliack muscle and the *Psoas*. 1. Muscula inferior.

Secondly, the *Hypogastrick*, which is large, and at the lower end of *Os sacrum* runs to the Bladder and its Neck, and the Muscles that cover the *Ossa pubis*. In *Men* it goes also along the two nervous bodies of the *Penis* as far as the *Glans*: and in *Women* it is distributed in numerous branches into the bottom of the Womb and its Neck, out of which for the greatest part issue the *Menses* in their monthly purgation. It goes also to the *Podex*, where it makes the external hemorrhoidal Arteries. 2. Hypogastrica.

Thirdly, the Umbilical artery, which ascending by the sides of the Bladder, and being inserted into the duplicature of the *Peritonaeum*, proceeds to the Navel, out of which it passes in a *Fetus* in the Womb, and runs into the *Placenta uterina*, of which before, Book 1. Chap. 33. But after the Infant is born, when there is no more use of it, it closes up, and hardens into a Ligament, sustaining the Bladder, and hindring it from pressing on its Neck. 3. Umbilicalis.

From the *exteriour branch* of the *Ramus iliaca* two Arteries arise.

4. Epiga-
strica.

First, the *Epigastrick*, which turning upwards on the outside of the *Peritoneum* runs betwixt it and the *Musculi recti* of the *Abdomen* as high as the Navel, where the Mammary artery meets it, and according to tradition (though false) inosculates there with it. Of which before, in this Chapter.

5. Pudenda.

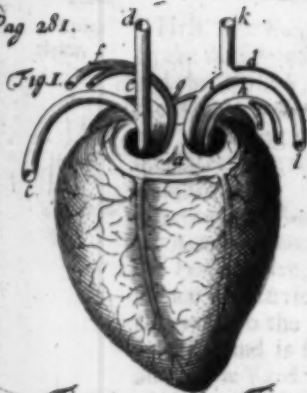
Secondly, *Pudenda*, which sends forth a notable Artery on each side into the nervous body of the *Penis* in Men, and into the *Clitoris* in Women. Hence it is carried inwards by the jointing of the *Ossa pubis* to the *Pudenda* and Groins, and their Glands, and is spent on the Skin of those parts, and of the Yard.

When all these pairs of Arteries have arisen out of the *Rami iliaci*, they run down out of the *Peritoneum* to the Thighs, where they begin to be called *Crunales*, where we shall leave them till we come to speak of the Arteries of the Limbs, Book 4. Chap. 5.

Having now traced all the Arteries springing out of the *Aorta* (whether out of its ascending or descending Trunk) in the *Thorax* and *Abdomen*, taking occasion to doe so, because the great Artery out of which they all arise, has its origine in the Heart, to which we have considered it as an appendage; we shall pass on to the description of the remaining parts in the Breast, not yet spoken to.

XI. Art.





The Explanation of the Table.

Figure I.

Representeth the Vessels that go into and out of the Heart.

- a *The Basis of the Heart.*
- b *The Mucro or Cone of the Heart.*
- c *The trunk of the Cava ascending from the Liver.*
- d *The trunk of the Cava above the Heart descending from the Claviculae.*
- e *The uniting of these two Trunks as they enter into the right auricle of the Heart.*
- f *The Arteria pulmonaris rising out of the right Ventricle, and passing towards the Lungs.*
- g *The Canalis arteriosus from the Arteria pulmonaris to the Aorta, pervious in a Fœtus in the Womb.*
- h *The Vena pulmonaria coming from the Lungs, and entering into the left ventricle of the Heart.*
- i *The Aorta ascending out of the left ventricle of the Heart.*
- k *The ascending trunk of the Aorta.*
- l *The descending trunk of the Aorta.*

Figure II.

Figure II.

Representeth the oblique Fibres of the Heart (lying under the streight, which are outermost, but here removed) which ascending from the left side towards the right obliquely, terminate in the basis of the Heart, (from Doctor Lower.)

- a *The basis of the Heart.*
- b *The Cone.*
- c *The Fibres that encompass the left Ventricle.*
- d *The Fibres encompassing the right Ventricle.*
- e *A Sinus in the interstice of the Ventricles made for receiving the vessels of the Heart.*

Figure III.

Representeth a second rank of oblique Fibres lying under the former, and running clean contrary, from the right side of the Heart to the left, (also from Dr. Lower.)

- a *The basis of the Heart.*
- b *The Cone.*
- c *The right side of the Heart.*
- d *The left.*
- e *The Fibres of the right Ventricle.*
- f *The Fibres of the left.*

Figure IV,

Figure IV, V, VI, VII.

Represent the Valves of the Vessels that go into and out of the Ventricles of the Heart.

Figure IV.

- A *The orifice of the Vena coronaria.*
- B *A print of the Anastomosis between the Vena cava and Pulmonaria, by means of the Foramen ovale.*
- CC *The Valvula tricuspides with the Fibrillæ by which they are tied.*

Figure V.

- A *The right Ventricle of the Heart opened.*
- BBB *The Valvula sigmoides of the Arteria pulmonaris.*

Figure VI.

- AA *The Vena pulmonaria laid open.*
- B *A print of the Foramen ovale opening into it.*
- CC *The two Valvula mitrales.*
- D *The left Ventricle laid open.*

Figure VII.

- A *The Aorta cut open near the Heart.*
- BBB *The Valvula semilunares in the orifice of the Aorta.*

CHAP. XII.

Of the aspera Arteria and Lungs.

AS in the first Book, being to treat of the Stomach, we first described the Gullet, which serves as a Tunnel to it; so the same reason induces to begin with the Windpipe, called *Trachea* or *aspera Arteria*, thereby to usher in the description of the Lungs, to which it performs the same office as the Gullet to the Stomach, this receiving in Air, as that does Meat and Drink.

*The wind-
pipe.*

The *Aspera arteria* then is a long Pipe, consisting of Cartilages and Membranes, which beginning at the Throat or lower part of the Jaws and lying upon the Gullet descends into the Lungs, through which it spreads in many branchings.

Its parts.

1. *Larynx*, It is commonly divided into two parts, the upper which is called *Larynx*, and the lower, that is named *Bronchus*. Of the former we shall speak in Chap. 14. where we shall treat of the parts contained in the Neck; of the other here.

2. *Bronchus*.

By the *Bronchus* we mean all the *Trachea* besides the *Larynx*, as well before as after it arrive at the Lungs. It is joined immediately to the *Larynx*, to whose lowest Cartilage all those of the *Bronchus* are assimilated. These Cartilages are like so many Ribs, Hoops or Rings, seated one below another at equal distances, and kept in their places by the *inner* membrane of the *Trachea*, which fills up their interstices and ties them one to another like a Ligament. Yet these Rings have

have not their circle intire, but on the back-side of the *Bronchus* next the Gullet, that they might give way to the Meat in swallowing, they pass into a Membrane, which is the same with the inner Membrane that ties them together. So that they are in figure like the letter C.

Besides the inner there is also an *outer* Membrane that helps to connect these Cartilages the more firmly one to another, and the whole *Trachea* to the neighbouring parts, that it may more safely and firmly descend into the *Thorax*. This is much thinner than the other: for the inner (according to Dr. *Willis*) has two rows of muscular Fibres, the outer streight, the inner oblique; the first by their contraction shorten the *Trachea*, the latter straiten it: so that he thinks they assist expiration, especially when it is violent, as in coughing, hawking or the like. It is also of most exquisite sense, as every one knows, being the least thing offends it and causes a Cough, which is a sort of Convulsive motion. And this it owes to the recurring Nerves of the sixth pair (Dr. *Willis*'s eighth) creeping along it more than the outer. It is usually besmear'd with a fattish and mucons humour, to hinder its drying, and to make the voice smother: for when this humour is fretted off in Catarrhs, or it becomes unequal from any cause, the voice becomes hoarse; and when it is dried by too much heat, as in Fevers, it becomes squeaking.

The *aspera Arteria* has *Veins* from the external *Jugulars*. *Arteries* from the *Carotides*, and from the *Arteria bronchialis*, (first found out by *Frederick Ruysch*) which springs from the backside of the descending trunk of the *Aorta*, a little above the

the lower Intercostals. *Nerves* it receives from the recurring branches of the *par vagum*, as above-said.

Division.

When it is descended as low as the fourth *vertebra* of the *Thorax*, it is divided into two Trunks, whereof one goes into the right lobe of the Lungs, the other into the left, and each is presently again divided into two, and those into others, till at last they end in very small branches, which are dispersed among the roots of the pulmonary Artery and Vein, and end into and are continued with the little Bladders that make up the greatest part of the *Parenchyma* of the Lungs. For

The Lungs.
Their substance.

Though the Lungs (called in Greek *πνεύμων*, *to breathe*) have been held to be of a carnosus substance, not much unlike the Liver or Spleen; yet *Malpighius* hath discover'd them to have a far other *Parenchyma*, namely soft, spongie and rare, made up of most thin and fine Membranes continued with the inner coat of the *Trachea*, which Membranes compose an infinite number of little round and hollow Bladders, so placed that there is an open passage from the *Trachea* out of one into another, and all are terminated at the outer Membrane that incloseth the whole Lungs.

These Bladders though they are continued to the *Bronchia*, yet they have no Cartilages as those have; but though they are very fine, yet they have muscular Fibres, whereby they contract themselves in expiration, but not so close as to expell all the Air included in them; for if the *Parenchyma* of the Lungs had fallen flat and close in expiration, it would have given some stop to the

the circulation of the Blood through them out of the pulmonary Artery into the Vein; whereas now that there remains still so much Air in these *Vesiculae* as to keep the Lungs a little pufft up and rare, the Blood can pass the more easily and swiftly through them.

That there are such Bladders annexed to the *Bronchia*, *Diemerbroeck* shews by two notable Stories: The one of a Stone-cutter's Man that died of an *Asthma*, in whom he found these *Vesiculae* so stufft with the dust of the hewn Stone, that when he cut his Lungs open, his Knife seem'd as if it went through an heap of Sand: The other of one that being employed to pick and cleanse Feathers, died of a long continued *Asthma*, and had these Bladders quite fill'd with the fine Dust or Down of the Feathers. From whence he concludes, That whereas in a natural state the Air in inspiration is received as well into these Bladders as the *Bronchia*, seeing they could not now admit any Air, being stufft with the aforesaid matters, the Patients were necessarily Asthmatical, and dyed so.

We said before that all these *Vesiculae* were ^{Investing} invested with a common Membrane in the ^{membrane.} *superficies* of the Lungs; and this *Dr. Willis* will have double: The *outer* tunicle is thin and smooth, which seems to be a fine texture of nervous filaments; the *inner* rough and thicker, consisting almost wholly of the extremities of the Vessels and *Vesiculae*; and through the little pits that are all over made in it by them, its inner *superficies* looks like an Honey-comb. This investing Membrane consisting thus of two Tunicles has many large pores, but such as admit not any thing to pass from within

within outwards; for if one fill the Lungs newly taken out of a Sheep or the like (before they are cold) with a pair of Bellows never so full of wind, there will none pass out of the Membrane, not so much as to make the flame of a Candle to wave: but on the other side they do admit even liquors to pass from without inwards; so when the Breast has been opened to let out matter in an *Empyema*, (which was too thick to be absorbed by the too narrow pores) and bitter cleansing injections have been squirted into the cavity of the *Thorax*, to clear it from the purulent matter stagnating in it, it has been observed that a good part of such injections have been hawked and cough'd up. And though some think that whensoever *Pus* is cough'd up, it is certainly bred in the Lungs themselves; yet I am of opinion that in an *Empyema* when it is thin, these pores may be so large as to imbibe it even out of the cavity of the *Thorax*; otherwise I see not how any labouring of an *Empyema* should ever be cured without tapping: for of the two I think this a far more probable way to discharge the matter by, than that it should be imbib'd by the mouths of the Veins gaping (as is suppos'd) either in the superficies of the *Pleura* or *Diaphragm*. But to proceed.

Division.

The Lungs are divided into the right and left part, being parted by the *Mediaſtinum*, and each part is otherwise called a *Lobe*. And because they are two, that have no communication one with the other (save in one *Trachea*, by which the Air comes into and goes out of them) hence in common speech we say *Lungs* in the plural. Each of these parts or Lobes is subdivided into
two,

two; sometimes three others, and those into many lesser Lobules, as may be seen in the following Figure taken from Dr. Willis.

The Lungs hang by the *Aspera arteria* that runs through the middle of their substance, and so by its means adhere to the Neck. Preternaturally (though pretty often) they cleave by their outer superficies to the *Pleura*, and sometimes with their lower end to the Diaphragm.

They have all sorts of Vessels, that are common to them with other parts; but peculiar to themselves they have *Bronchia* or the branches of the Wind-pipe, for bringing in and carrying forth of Air.

Their *Arteries* and *Veins* are the *Arteria* and *Vena pulmonaris*, that accompany all the divisions of the *Aspera arteria* within their several Lobes. These open one into the other by many anastomoses, and are interwoven one with another all through the coats of the *Vesicula*. But of these we discoursed so largely before, Chap. 10. that we shall say no more of them here. Besides these, that were all the sanguiferous vessels Anatomists had observed to reach to the Lungs, there has of late been found out an Artery by *Frederick Ruysch* (which he calls *Arteria bronchialis*) that seems to convey Blood for the nourishment of the Lungs and *Bronchia*. But of this likewise before (in this Chapter.)

They have abundance of *Lympheducts* that attend upon the Veins and Arteries. Their small twigs running upon the outer superficies of the Lungs, towards their root unite into several greater trunks; which being inserted into the common thoracick duct, discharge thereinto the

Lympha imbibed by them in the Lungs. They may be made to appear very plain in the outward surface, if in dissecting a Live-dog, one press upon the top of the thoracick duct, so as nothing be poured from thence into the Subclavian vein: for then the Lympheducts of the Lungs, seeing they cannot unload themselves into the common duct that is now stopt and full, will swell very much and be very conspicuous. If these Lympheducts at any time be obstructed or broken, Dr. *Willis* thinks there often proceeds from thence a Dropsie of the Breast or Lungs, yea Coughs and Phthisical distempers.

4. *Nerves*. The last sort of Vessels dispersed in the Lungs are the Nerves. And these proceed from the recurring Nerves of the *Par vagum*, usually called the sixth pair, but Dr. *Willis*'s eighth, who says they are distributed all over the Lungs along with the sanguiferous Vessels and ducts of the *Bronchia*, to supply animal spirits to the muscular Fibres of their Coats.

Their *Action* is respiration, of which in the next Chapter.

The Explanation of the Table.

Figure I.

Representeth the *Sternum* cut off and lifted up, the *Mediastinum*, *Thymus*, Lungs, *Diaphragm*, &c.

AAA The inner superficies of the *Sternum* and of the *Cartilages* knit to it.

BB The

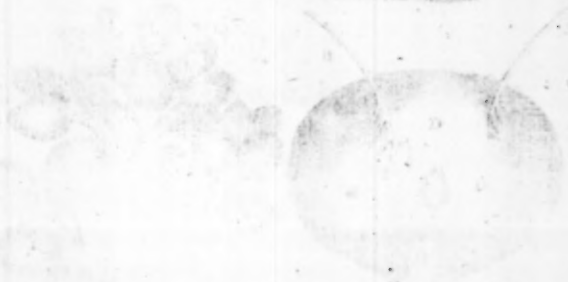


Fig. I.



Fig. 2.

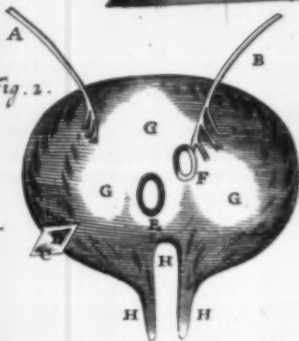


Fig. 3.



- BB *The mammary Veins and Arteries descending under the Sternum.*
C *The glandulous body called Thymus.*
DDDD *The sides of the Mediastinum pull'd asunder from the Sternum.*
EE *The space between the Membranes of the Mediastinum, arising from the tearing of it from the Sternum.*
GG *The Lungs.*
HH *The Diaphragm.*
I *The Cartilago ensiformis.*

Figure II.

Representeth the Diaphragm with its processes.

- A *The left Nerve of the Diaphragm.*
B *The right.*
C *The upper membrane of the Diaphragm a little separated.*
D *The carnos substance of the Diaphragm bared.*
E *A hole for the Gullet to descend by.*
F *A hole for the Vena cava.*
GGG *The membranous part or centre of the Diaphragm.*
HHH *Its processes or appendices, betwixt which the great Artery descends.*

Figure III.

Representeth a piece of one Lobe of the Lungs,
(according to the ramifications of the *Aspera*
arteria) divided into many lesser Lobules,
(from Dr. Willis)

A The muscular Villi or Fibres running streight
lengthways in the inside of the *Aspera arteria*,
upon which other circular ones lie.

BBB A part of the trunk of the Trachea, as also its
branches that make the lesser Lobules, uncut
open, that their annular Cartilages may be
seen.

CCCC The secondary Lobules hung upon the stems of
the Bronchia like Grapes (which might yet
be divided into lesser Lobules) all whose
inner ducts pass out of the Bronchia into the
Air-bladders, or vesicular cells.

dddd The sanguiferous vessels creeping along the su-
perficies of the Lobules.

CHAP. XIII.

Of Respiration.

THE *Action* for which the Lungs are appointed by Nature is *Respiration*, which is an alternative *Diaστοle* and *Systole*, or dilatation and contraction of the Breast, whereby the Air is received in, and driven forth of the Lungs.

Now the Lungs do not dilate themselves by any proper power or faculty of their own, being destitute of instruments to perform such an action; nor do they attract the Air by any magnetick property, in inspiration: But the Muscles of the *Thorax* being so framed, that though contraction be the only and proper action of a Muscle, yet the *Thorax* is dilated by certain of them, as it is contracted by others; whilst it is dilated, there is greater space given for expanding the Lungs, and then the Air by its proper elastick virtue does of its own accord issue in at the *Trachea*, and insinuates it self into all its *Bronchia* and into the *Vesicula*, and puffs them all up; namely to the end that its nitrous particles may every where meet with the Bloud as it glides through all the parts of the Lungs: And when the Breast receding from that dilatation is contracted, the Lungs, being partly compressed thereby, and partly by the muscular Fibres of the *Vesicula* and of the inner coat of the *Trachea* and *Bronchia*, expell the Air out again.

The Muscles that assist the dilatation of the Breast, are those that lift up the Ribs and draw them

How respiration is performed.

Muscles ministering to respiration.

them backwards ; which shall be described Book 4. Chap. 15. And besides these there is another internal Muscle, namely the Midriff, that contributes towards it, as was shewed Chap. 3. of this Book, where we treated of it. And as for the straitning or condidence of the *Thorax*, that it is not only a motion of restitution, or a cessation of the foresaid Muscles from their action, is evident, seeing sometimes expiration is performed more laboriously and violently than inspiration, as in coughing, holloeing, or the like. And therefore Nature has provided peculiar and proper Muscles for that purpose, described in the same Chapter of the fourth Book ; and these are assisted partly by some Muscles of the *Abdomen*, and partly by the muscular Fibres of the *Vesicle*, *Trachea* and *Bronchia*, as abovesaid.

What kind
of motion
respiration
is.

There hath been great controversie among Philosophers whether respiration be an Animal or Natural motion. That it is *natural*, is thought to be proved, both in that it is performed as well when we are asleep, as awake, and also that though it be continued through a Man's whole life, yet we are never wearied with it, as we are with animal and voluntary motions. On the other side some prove it to be *animal*, first because it is performed by such Instruments as serve for animal motion, namely Muscles ; and secondly because at our pleasure we can make it quicker or slower, stronger or weaker, or alter it how we please. Others thinking the arguments on either side convincing, take both in, and suppose it a kind of mixt action, partly natural, and partly spontaneous. But I think there is no necessity from the arguments alledged to grant this motion

motion to be natural, or any more than animal or spontaneous. For as to the *first* argument, that the motion is as well performed when we sleep as when we are awake, and therefore it cannot be voluntary; if this were allowed to be of force, we must also grant walking and talking to be natural motions, because many perform them both, when they are asleep. And as to the *second*, from our not being wearied by it, in answer to it we may distinguish of animal actions, into such as are done by instinct and are free, and into such as serve the affections of the mind: the former proceed always and without impediment, even when we think not thereon, but may notwithstanding be directed and moderated when we do think of them, and such is respiration; the latter is not performed continually, as to run, leap, write, &c. In the former there is a plentiful and continual influx of animal spirits into the Muscles, of custom or course; whence there follows no weariness, though they be continual: In the latter, seeing by the determination that is made in the Brain the spirits now flow in and anon cease, sometimes in greater plenty and sometimes in less, from this mutation and unaccustomedness does the weariness proceed.

Respiration is so necessary to the continuance *The use of* of life, that after once the *Farm* comes into the *in.* open Air and begins to breath, it can hardly live two minutes without it. But upon what account it becomes so necessary is not agreed among learned Men, each party exhibiting such reasons of it, as may best suit with their hypotheses. Hence *some* (and those the most) think that respiration serves for the cooling and ventilating of the Blood

Bloud that acquires a great heat in the right Ventricle of the Heart, and also for the carrying out fuliginous streams therefrom. *Others*, that it serves for the better mixture of the particles of the Bloud as it passes through the Lungs, as also to further its circulation. *Others*, that the Air is inspired for the greater subtilization of the Bloud, and inkindling of the vital spirits, or (to continue the metaphor) vital flame. More opinions there are, but this last is (if not the truest) the most ingenious, and is very learnedly maintained by Dr. Willis, Dr. Charleton, &c. whom the Reader may be pleas'd to consult for further satisfaction.

A secondary use is to form the voice; for such Creatures as breath not (as Fish, &c.) are mute.

CHAP. XIV.

Of the Neck and the parts contained in it, viz. the Larynx, Pharynx, Tonsillæ, &c.

HAVING now dispatched all the parts of the middle Venter or *Thorax*, we should next proceed to the highest, viz. the Head; but betwixt these two is the Neck, like an *Isthmus* between them, which therefore we must take in our way, and describe the parts contained in it.

Its name.

It is called *Collum*, either a *Colendo*, because it used to be adorned with Chains, &c. or because it riseth out of the trunk of the body *instar Collis* like an Hill. *Collum* is a general name

name for the whole Neck ; yet the hinder part of it is particularly called *Cervix*.

The parts of it are either *containing*, or *con- Parts con- tained*. The *containing* are the same which are *taining*. found in the rest of the Body , saving that the *Membrana carnosa* seemeth to be more fleshy.

The parts *contained* are these.

Contained.

1. The *Larynx*, which is the upper part of the 1. *Larynx*. Wind-pipe, and the instrument of forming the voice.

It is almost round and circular in figure, only *its figure*. jetting out a little before, and something flattish behind, to give way to the Gullet in swallowing.

Its bigness differs according to age, sex, and *Bigness*. temperament, whence proceeds the great diversity of voices. Such in whom it is narrow, as in younger people , have shrill and small voices ; such as have it wide and are come to maturity, have fuller and more hoarse. The voice is altered also in respect of the length or shortness of the *Larynx*, and as the Air is more strongly or weakly expelled.

It has Arteries from the *Carotides*, Veins from *Vessels*. the external Jugulars, and Nerves from the recurring branches of *par vagum*.

Besides the Membranes which are common to it *Substance*. with the rest of the *Trachea* (described before, Chap. 12.) it is made up of five Cartilages and thirteen Muscles.

The *first* Cartilage is called *scutiformis*, *Cartila-* or Buckler-like ; for within it is hollow , but *ges*. without embossed or convex : that part which sticketh out is called *pomum Adami*, from an idle fable, that part of the fatal Apple by God's judgment stuck in his Throat, and that this Cartilage being

being thereby distended was made to jet out, and the protuberance propagated to posterity. It is greater in Men than in Women. The *second* Cartilage is called *κατακλις annularis*, because it is like a Turkish ring, and compasseth the whole *Larynx*; in the hinder part it is broad and thick. The *third* and *fourth* because of the Membrane that invests them, seem but one, but it being removed they appear to be two. However they have but one name which is *αεσαυοειδης guttalis*, because when their two processes are joined together, they are *instar gutturnis* like to that part of the neck of a Jug or Ewer at which we pour out the water. For by their juncture they frame a *rimula* or little chink for the modulating of the voice, called *Glottis*. The *fifth* is called *Epiglottis*, because it is placed above the *Glottis* or Chink, and covereth it. It is of the form of a Tongue, and is appointed to hinder the falling down of any thing which may prove offensive unto the Wind-pipe, when we eat or drink. It is pressed down by the weight of the things which are swallowed, and turneth them down to the *Gula*.

Muscles.

The Muscles by which these Cartilages are moved in forming the voice, are thirteen in number; but as for their names and description, the Reader may please to consult Book 5. Chap. 11.

2. Pharynx.

The second part contained in the Neck is the upper part of the Gullet, which is called *Pharynx*, from *ειρω*, because it conveyeth the Meat and Drink towards the Stomach. It is continued to the *Fauces*, (or indeed is the greatest part thereof) reaching up behind to the *Uvula*, on the sides to the *Tonsilla*, and before to the *Epiglottis*.
It

It is membranous, but not purely so, for it is thick and in some sort carnos. It has seven Muscles, to assist it in swallowing, three pair to open it, and an odd one, which is called its Sphincter, to straiten it, of which Book 5. Chap. 12.

The next parts are the *Tonsilla*, commonly called *Almonds*, which are two Glands seated at the root of the Tongue, on each side of the *Uvula*, and at the top of the *Larynx*, covered with the common Membrane that invests all the Mouth. They are of a yellowish colour, and Dr. *Wharton* compares their substance to concreted Honey, only they are of a more firm consistency, but they look sandy like it: They have small vessels from the Jugular Veins and Arteries, and Nerves from the fifth and sixth pair.

They have each a large oval common Duct or *Their duct*. *Sinus* that opens into the Mouth, so wide in an Oxe that one may put the top of ones little finger into it. Into this many lesser open, and by it discharge into the Mouth, &c. the liquor that is separated in the Gland.

The use of these Glands is to separate a certain *Use*. mucous or pituitous matter from the Bloud, for the moistening and lubricating of the *Larynx*, Tongue, *Fauces*, and Gullet. Dr. *Wharton* ascribes a more noble use to them, viz. to make a Ferment to further the concoction of the Stomach, yea thinks that they are the chief Instrument of taste.

There are several other Glands that are near to these, as 1. the *Thyreoidæa* that are seated towards the lower part of the *Larynx* at the sides of the

the Cartilages *Thyreoides* and *Cricoides*, &c. 2. The Jugular, placed by the Jugular vessels; of which Dr. *Wharton* has told fourteen on each side: 3. *Parotides*, situated at the root of the Ear; which whoso would see accurately described, may consult the said Dr. *Wharton*, in his *Adenographia*, cap. 18, 19, 20. for they are too minute and inconsiderable parts to fill up any large room in this *Epitome*. Neither shall we mention the Veins and Arteries that pass through the Neck to the Head, having described them before in Chap. 9. and 11.

As to other parts that make up the Neck, viz. the seven *Vertebra*, and eight Muscles, those will come to be treated of in their proper Books: And therefore we shall pass immediately to the highest *Venter*, the Head.

The end of the Second Book.

The Third Book.

OF THE H E A D.

CHAP. I.

Of the Head in general, and its common containing parts.

NOW followeth the third and highest *Venter* of the Body, called *Caput*, the Head. This is the most noble Cavity of the three, containing the Brain, wherein the rational Soul more especially operates, and whereby all the animal motions of the whole Body are moderated and determined; as well as performed by means of the spirits elaborated in it, and sent into all the parts by the Nerves.

It is placed in the highest region, most fit for *its seat*. the organs of the Senses, but chiefly for the Eyes; for they ought to be placed there as in a Watch-tower: and besides having but soft Nerves which could

could not endure a long passage, it was requisite that the Brain should be near them.

Figure. Of figure it is spherical; yet somewhat flattish, and longish.

Bigness. It is bigger in Man than in other Creatures, considering the proportion of their Bodies; as his Brain also is.

Parts. The parts are of three sorts, for they are either 1. distinctive, or 2. expressive of the regions, or 3. constitutive of the whole.

The parts *distinctive* are two, the hairy scalp called *Calva*, and that without hair called *Facies*.

The parts which *express* the regions (of the first,) are four: 1. *Sinciput* or the fore-part, reaching from the Forehead to the coronal suture. 2. *Occiput* the Noddle, or hinder part, beginning at the suture *Lambdoides*, and reaching to the first *vertebra* of the Neck. 3. *Vertex*, the Crown, which is situated on the top of the Head between the bounds of the *Sinciput* and *Occiput*. And 4. the lateral parts descending from this on each side between the Ears and Eyes are called *Tempora*, or the Temples.

The parts *constitutive* are either *containing*, or *contained*. The *containing* are either *common* or *proper*. The *common* are those we treated of in Chap. 3. of the first Book, *viz.* the *Cuticula*, *Cutis*, *Pinguedo*, and *Membrana carnosæ*. The *Cuticula* is thinner and softer; but the Skin thicker, than in any other part of the Body, yet porous, to give way to the nourishment of the Hair. The *Membrana carnosæ* in some cleaveth so to the Skin, that they can move it at their pleasure.

We shall not need to say more here of these

common

common containing parts, but refer the Reader to the above-cited place; and now proceed to the proper, having first discoursed a little of the Hair.

CHAP. II.

Of the Hair.

THE Hairs of the Head are called in Latine *Capilli*, quasi *Capitis pili*, and differ not from the Hairs in any other part of the Body, save in length. *Its name.*

Now an Hair may be defined to be a body cold and dry, small, thread-like, hard and flexible, budding from the Skin. *Definition.*

The Hairs are seldom round, but generally four square, as the stalks of some Plants; sometimes triangular, but always porous, the pores running lengthways. All these things may be observed in a good Microscope. They are sometimes curled, and sometimes hang lank. *Figure.*

Hairs are commonly divided into *Congeniti*, such as we bring into the World with us, as those of the Head, Eyelids, and Eyebrows; and *Post-geniti*, such as begin to grow at certain seasons in our life-time, as the Beard, the Hairs growing about the *Pudenda*, on the Breast, in the Arm-pits, and the like.

They are no parts of the Body, and therefore have no Animal life; yet they have a Vegetative life, and that peculiar to themselves, and not owing to the life of the Body, seeing they continue

nue

nue to grow after a Man is dead, as has been observed in embalmed Bodies.

Matter.

The matter out of which they are bred and nourished is commonly reputed to be a moist, fuliginous, crass, earthy and somewhat viscid excrement of the third concoction. *Spigelius* thinks they are nourished by Blood: which opinion he grounds on an analogy he supposes there is between Hair, and the Feathers of Fowl; and these latter he says are apparently nourished by Blood, for if one pull one from off a young Fowl, its end is bloody. *Diemerbroeck* dissents not much herefrom, but thinks the Blood to be prepared and concocted in a specifical manner into a crass, earthy and viscid juice. Whatever the matter be, it is attracted by the white roots of the Hairs, and is carried even to their very ends by the pores; just as Plants receive nourishment out of the Earth by their Roots, and communicate it to their outmost parts.

Colour.

The colour of them is answerable to the Climate, or to the natural constitution of the party, or to the diversity of those humours that are mixed with the juice whereby they are nourished. In those of cold flegmatick constitutions they use to be of a light colour, in cholerick, reddish, &c. They are most commonly streight in those which are born in cold Countries, but curled in those who inhabit hot Climates.

*Why hair
turns
white.*

And as the reason of the difference of the colour of the Hair in several persons is from different temperaments, &c. so the reason why Men in old age grow grey, whenas their Hair before was of another colour, seemeth to be the predominance of flegm in that juice that nourisheth them:

them: whence also the Hairs of the Head and Face soonest turn white, because the Brain does more abound with pituitous humours than any other part of the Body. But it is not so easy to give a reason of some Men's turning grey in one nights time, when they have been under great fears; of which there are many instances credibly reported.

The Hairs have three *uses*: for they serve 1. for *Their use*, defence, 2. for beauty, and 3. shew the temperature of the whole Body and Skin.

CHAP. III.

Of the proper containing parts.

THE *proper containing* parts are five; to wit, the Muscles, the *Pericranium*, the *Periosteum*, the *Cranium*, and the *Meninges*. Look for the Muscles in the fifth Book, and for the *Cranium* in the sixth. Of the other here. And First

The *Pericranium* is a Membrane thinnish, dense and white, of exquisite sense, immediately seated under the *Membrana carnosæ*. It covereth the whole Skull, except where the temporal Muscles lie upon the *Cranium*, for it is stretched over them, and seeing it is very sensible and tender, it causeth horrible pain and inflammation, when the temporal Muscle is wounded. *The Pericranium.*

It is tied to the *Dura mater* by some nervous Fibræ, which pass within the Skull by its Sutures, to stay firmly the *Dura mater*, and also the Brain which it invests, from inordinate moving. And *Its connexion.*

although in Infants new born these be strongly united, insomuch that the *Pericranium* is said by some to spring from the *Dura mater*; yet in process of time they part, and become joined only by some fibrous ties, by which, inflammations may be communicated from the *Pericranium* to the Brain.

Periosteum.

Next under the *Pericranium* is spread the *Periosteum*, which immediately cleaveth to the Skull and gives it that sense which it hath. It self is a very thin and nervous Membrane, and of very acute sense. All the Bones of the whole Body (except the Teeth) are invested with such alike Membrane, and owe their sense to it. Some deny it to be found here, affirming that the *Pericranium* supplieth its place: But that cannot be so, for the *Pericranium* (as was noted above) goeth above the temporal Muscles, whereas the *Periosteum* always cleaveth close and immediately to the Bone, as here it doth to the Skull under the said Muscles.

Their vessels.

These two Membranes outwardly investing the *Cranium* have Arteries from a branch of the external *Carotides*, and Veins from the external Jugulars.

The Meninges.

The *Meninges* follow, called by the *Arabians*, *Matres*; as if all the Membranes of the Body were propagated from them. These are immediately within the Skull as the other were without; but adhere not close thereto, as those do. They are two in number: the *Crassa meninx* or *Dura mater*, and the *Tenuis meninx* or *Pia mater*.

Dura mater.

The *Dura mater* is the outer, that is, is next to the Skull, through whose Sutures sending Fibres to the *Pericranium*, it is suspended thereby; for in other places it is loose from the *Cranium*, saving

saving in its *basis*, to which it is so firmly knit, that it can hardly be pulled from it; or where it is suspended by Vessels entring into it from the perforations of the Skull. It is thicker and harder than the inner, whence it has the epithet of *dura*, hard. It consists of a double Membrane, the outer of which is more rough, towards the *Cranium*; and the inner is more smooth and slippery, and as it were bedewed with water. It is knit to the *Pia mater* by many vessels that pass from it thereto.

It has many *foramina* or holes for the transit of *its holes*. the Vessels; and besides, one very large one at the descent of the spinal marrow, and another toward the *Glandula pituitaria*: And where it adheres to the *Os cribriforme*, it is perforated like a Sieve.

It has Arteries from the larger branch of the *Vessels*. *Carotides*, entring into it through the holes of the wedge-like Bone, and that of the Forehead. These in some places run out of it into the *Pia mater*, by means whereof they are in some measure knit together. *Veins* it has from the internal Jugulars.

At the Crown of the Head it is doubled, from *Falx*. whence its duplicature descending inwards, divides the Brain into the right and left side. This duplicature, because it is broader backwards, and grows narrower forwards, and so resembles in some manner a Reaper's Sickle, is called *Falx*. Now this *Falx* reaches as far forwards as to the top of the Nose, where it grows to the Partition-bone that distinguishes the *Processus mammillares*, and is called *Galli crista* or Cock's comb. But its hinder and broader part towards the *Occiput*, being

ing severed, descends towards both the right and left side, and distinguishes the *Cerebellum* from the *Cerebrum*.

Sinus.

In the said duplicature are formed four *Sinus* or Cavities, three pretty large, and one little one. The first which is the highest and longest, runs along the upper part of the *Falx*, from the top of the Nose lengthways of the Head towards the *Occiput*, where it is divided into two lateral *Sinus* descending by the sides of the Lambdoidal suture to the basis of the *Occiput*. And at the said division the fourth short *Sinus* proceeds inwards to the *Glandula pinealis*. Into these Cavities the Mouths both of Arteries and Veins are said to open; by the former whereof Blood is extravasated into them, and absorbed again out of them by the latter. Whence if one open the Skull of a live-Creature, one may observe a beating in the long uppermost *Sinus*, from the Blood discharged into it by the Arteries. And some are of opinion that the Veins also convey some Blood into them, which being superfluous to the nourishment of the Brain and *Meninges* is poured in hither by the Veins from the respective parts, and is imbibed again by other Veins opening into them, namely the inner branches of the Jugulars, to be returned to the Heart. The placewhere all these *Sinus* meet together at the *Occiput*, is called *torcular Herophili*.

Pia mater.

The second (and inner) Membrane investing the Brain is called *Tenuis meninx* or *Pia mater*. This is of most exquisite sense, and endowed with very many Arteries and Veins. It immediately cloaths the Brain and hinders it from running about, and also involves all its windings and circuits, and tying

tying their summities together makes all the superficies of the Brain plain as it were: which upper connexion being loosed, the windings of the Brain, because they are invested with this Membrane, may easily be separated and laid open. From this same *Meninx* proceeds also a most thin Membrane investing the inner Ventricles of the Brain.

This Membrane is interwoven with many admirable *Plexus* or Nets of most small Vessels, springing from the *Carotides* and cervical Arteries and Jugular Veins joined every where by mutual inosculations, that by so great a number of Vessels there might on every hand be affused Bloud enough for the nourishment of the Brain, and making of Animal spirits. Dr. *Willis* writes that he has observed very small Glands intermixt among these *Plexus* of Vessels, which he saith may be easily perceived in a moist or hydropick Brain, but not so well in others.

Both the spinal marrow extended to the bottom of *Os sacrum*, and all the Nerves that arise out of it, and out of the Brain, have a double Coat from these two *Meninges*, with which being cloathed they run to their designed parts.

CHAP. IV.

Of the Brain in general.

THE *Pia mater* being taken away, the Brain offereth it self, called by the Greeks *ἑνκεφαλον*. It is the general organ of sense, in which the Soul, the governour of the Body, perceives and judgeth of the sensations of all sentient parts, and out of which, as out of a fountain, it communicateth the beams of its benignity (namely the Animal spirits bred in the Brain) by the ducts or rivulets of the Nerves to all the sentient parts of the Body, and thereby endows them with the faculty of performing Animal actions.

Its substance.

Its substance is thick, viscous, soft, and white. It is not a Glandule, for it is the Work-house and Seat of the Animal spirits; but Glandules are appointed to receive excrementitious humours, and it is more curiously framed than any Glandule. Neither is it of a marrowy substance; for marrow swimmeth in water, but this sinketh. Besides, marrow nourisheth the Bones; but the Brain nourisheth no part. And lastly, Marrow being cast into the fire flameth, but so will not the Brain. It seemeth therefore to be a *Viscus* or Bowel, endowed with a peculiar sort of a *Parenchyma*, part of which *Malpighius* by the help of his Microscopes has observed to be of this substance, viz. That all the white part of the Brain (called the *Corpus callosum*) is evidently divided into flattishly round little Fibres, which in the
Brains

Brains of Fish are so apparent, that if you hold them betwixt you and the light, they represent the small teeth of an Ivory comb. These Fibres he saith are inserted by their ends into the *Cortex* or the ash-coloured outer part of the Brain, through which abundance of sanguiferous vessels are dispersed, and out of which therefore the aforesaid Fibres seem to draw their nourishment. Dr. Willis calls these Fibres *Canales* or *Stria*, whence the *Corpus callosum* might as well be called *Striatum*.

For nutrition and confection of Animal spirits *Vessels.* it receives Blood by Arteries derived from the *Carotides* and Cervical, whose Capillaries are dispersed through its substance: and what is superfluous to the said uses is partly imbibed by the Veins of the *Meninges*, and partly deposited in the *Sinu's* by the Arteries themselves, to be carried to the internal branches of the Jugulars, and thereby to the Heart. The Arteries inosculate one with another (*i. e.* the right *Carotides* with the left) as well as with the Veins. And it is from the Pulse of the Arteries altogether, that the beating (or *Systole* and *Diastole* as it were) of the Brain proceedeth.

A Man of all other living Creatures hath the *Pigness.* biggest Brain; for it weigheth four or five pound in some; and is as big again as an Oxe's Brain.

The outer surface is full of windings, like those *Figure.* of the Guts, which are severally invested with the *Pia mater*, as also tied together by it. The whole Brain is much of the same shape with the Head, *viz.* roundish, but with bunchings out towards the Forehead.

Of its *Action* we shall speak in the 9th Chapter.

CHAP. V.

Of the parts of the Brain properly so called, viz. Cortex, Corpus callosum, Septum lucidum, Fornix, three Sinus, Infundibulum, Glandula pituitaria, Plexus choroïdes, Rete mirabile, Nates, Testes, Anus, and Glandula pinealis.

THE Brain taken in a large signification hath three parts, *Cerebrum*, that which properly is called the Brain: the *Cerebellum*, or little Brain: and that part of the *Spinalis medulla*, which is within the Skull.

Now there are several methods of dissecting the Brain, some beginning behind, as Dr. *Willis*; some on the right side, as *Sylvius*; and some at the Crown, which is the old way, and this we shall follow, beginning with the *Cerebrum* properly so called, which lieth uppermost.

Its difference from the Cerebellum.

The Brain differeth from the *Cerebellum*; first, in substance, for it is softer; secondly, in colour, for it is whiter; thirdly, in bigness, for it is three times as big.

The division of the Brain.

The upper part of the Brain is divided into two parts by the *Falx* above-described, to wit, into the right and left. But this partition descendeth no deeper into the Brain than the thickness of the ash-coloured part of it, which is called

Its Cortex.

its *Cortex*. For if this be removed, that which lieth under it, being of a whiter substance, is a continued body, commonly called *Corpus callosum*,

Corpus callosum.

whose

whose substance we described above in the foregoing Chapter out of *Malpighius*. Dr. *Willis* says, it is wholly medullar : whence some divide the Brain (properly so called) into *Cortex* and *Medulla*.

The inferior part of the *Corpus callosum* maketh a partition, which is called *Septum lucidum*. *Septum lucidum*. It is loose and wrinkled ; but if it be spread out, and held to the light, it appeareth clear. It cleaveth above to the *Corpus callosum*, but below to the *Fornix*. Some will have it to be a reduplication of the *Pia mater* ; others a portion of the Brain.

Under the *Corpus callosum*, the *Fornix* or Vault *Fornix*. is seated, of the like substance. In the upper part it is arched ; but in the lower part convex : in figure it is triangular. It holdeth up the weight of this upper part of the Brain from bearing down on the subjacent parts.

There are several *Sinus* or Cavities in the Brain, *Sinus*. that are continued indeed to one another, yet because at the first view they seem separate, are considered by Anatomists as distinct, and they commonly reckon four of them : three of which are seated in the *Cerebrum*, of which in this Chapter ; and the fourth is common to the *Cerebellum* and *Medulla oblongata*, of which in the next.

The Brain being taken away as far as the *Corpus callosum*, there appear two of the said *Sinus*, *The two anterior*. which are called the superiour, lateral, or anterior, and which are divided into the right and left by the *Septum lucidum* just now described. They are something of the shape of Half-moons, or Horse-shoes, and being invested with a very thin Membrane, they descend forwards by a pretty large

Plexus
choroides.

large duct to the *Processus mamillares*. And backwards they descend to the basis of the Brain, in which place branches of the *Carotides* enter their Membrane, and make in it the *Plexus choroides*, together with some twigs of Veins interwoven with them. The Membrane wherein this *Plexus* is formed, has very many small Glandules, which separate a pituitous matter or flegm from the Vessels into the *Sinus*. Along which it has been supposed to flow to the *Processus mamillares*, and from them to destill through the *Os cribriforme* into the Nose. But Dr. Lower denies any such office of the *Os cribriforme*, affirming that the holes in it are only for the transit of the Nerves and Membranes going forth from the *Processus*, and that these fill them so close that nothing can flow through them. And says, that flux of Rheum through the Nose, upon the *Voula*, and into the Mouth, &c. in Catarrhs, falls not from the Head, but is separated from the Arteries in the Glands of the respective parts, as into the Nose through the Glands of its investing Membrane, &c. And as to the serous matter that is infused into these *Sinus* in the Brain, he says it is all absorbed again by the Vessels opening into them, and returns by the Jugular veins to the Heart.

The one posterior.

The third Ventricle is nothing else, but the meeting of the former two, towards the hinder part. In it there are two passages: the first in the fore-part, which marcheth streight-ways down to the *Infundibulum*. The second passeth under the *Testes* and *Nates* to the fourth Ventricle, and is called *Foramen ani* or *Vulva*.

Infundibulum.

The *Infundibulum*, or Funnel, is a certain Cavity

vity under this third Ventricle, passing down from about the middle of it, say some, but Doctor *Wharton* says out of the fourth. It is framed of the *Pia mater*, which being wide at its beginning, and becoming narrower towards its end, representeth a Funnel. It endeth in the *Glandula pituitaria*, Glandula pituitaria. which is placed in the cavity of the *Sella equina*, and upon the wedge-like Bone, through which it has been thought to destil upon the Palate, the slegm poured upon it by the *Infundibulum*. But Dr. *Lower* denies this, appealing to the structure of the parts, and his often experiments upon Calves heads: "In which, he says, the wedge-like Bone lying under the *Glandula pituitaria* is sometimes perforated in divers places, at least by one large duct, which being divided into two does on each side open into the Jugular veins: so that if Milk or Ink be injected through those ducts by a Syringe, it presently passeth through on each side into the said Veins; and nothing of tincture will appear about the Palate, Nostrils, Mouth, *Fauces* or *Larynx*. So that in a Calf the humour that proceeds from the Brain, returns all again into the Veins. And the same thing he says he has lately tried in a Man's Skull, wherein though the wedge-like Bone be never perforated, yet Nature has framed other ducts whereby all the *Serum* may be again derived out of the Ventricles of the Brain into the Blood: for there are two Vessels seated on each side the *Sella Turcica* (to be described Book 6. Chap. 6.) which with gaping Mouths as it were receive all the water destilled out of the *Glandula pituitaria*, and deposite it on each side into the Jugular veins without
"the

“the Skull; whose ducts will easily appear if
 “water or milk be squirted forcibly out of a Sy-
 “ringe into either Jugular vein near the Skull,
 “for the liquor will by and by break out near the
 “*Glandula pituitaria*, which makes it evident,
 “that whatever *Serum* is separated into the ven-
 “tricles of the Brain, and issues out of them
 “through the *Infundibulum*, destils not upon the
 “Palate, but is poured again into the Bloud and
 “mixed with it.] So that according to this
 opinion, the Rheum that issues so plentifully
 sometimes into the Mouth and *Fauces*, &c. falls not
 from the Brain, but, as was noted above, is se-
 parated from the Arteries immediately by the
 Glands of the respective parts.

About this Glandule, all over the sides of the
 aforesaid Cavity, there is a membranous *Plexus*
 framed of innumerable twigs of Arteries; which
 spring from the largest branch of the *Carotides*;
 that passeth by a proper hole in the bones of the
 Temples, into the capacity of the *Cranium*: it
 is called *Rete mirabile*, representing a Net spread
 abroad.

Rete mi-
 rabile.

About the hindermost passage of the third Ven-
 tricle which leadeth to the fourth Ventricle, cer-
 tain round bodies appear, being small protube-
 rances or portions of the *Medulla oblongata*. As
 first, and uppermost, there are the two ends of
 the roots of the said *Medulla*, which are called
Corpora striata, being of such a like substance as
 the *Corpus callosum* before described. The rest
 lying under these have their denomination from
 those things which they resemble. The first is
Glandula pinealis, or *Penis*; because it represent-
 eth the Pine-nut, or a Man's Yard. It is seated
 in

Penis.

in the beginning of that Pipe, by which the third and fourth Ventricles are united. Its *basis* is downwards, and its *apex* or end looks upwards. It is of a substance harder than the Brain, of a pale colour, and covered with a thin Membrane. This Gland *des Cartes* thinks to be the primary seat of the Soul, and that all animal operations draw their origine from it. But *Bartholin* has sufficiently confuted that opinion; for it seems to be but of the same use as other Glands, and particularly the *Glandula pituitaria* placed near it, *viz.* to separate the *Lympha* from the Arterial blood; which *Lympha* is reformed by the Veins (or it may be by *Vasa lymphatica*) as was shewn above from Dr. *Lower*. Near to this on both the sides of this third Ventricle four round bodies appear. The two upper are lesser, and are called *Testes*: the two greater are lower, and are called *Nates*. The Chink betwixt the *Nates* is called *Anus*.

Testes.
Nates.
Anus.

The use of these Ventricles is first for the more easie passage of the Blood; for it were not convenient for the sanguiferous vessels to be carried through the soft substance of the Brain; lest being compressed by the weight of it, the passage of the Blood should have been hindred. Whereas now it has no such lett, seeing the Vessels are interwoven in the Membranes that invest these *Sinus*, and make the *Plexus choroides* and *Rete mirabile* abovementioned. Another use is for the reception of the serous excrement of the Blood separated from it by the glandulous Membrane of the *Plexus choroides*, and *Glandula pituitaria*; which according to the old doctrine was discharged out of them by the sieve-like Bone at the top

The use of
the ventri-
cles.

of

of the Nostrils, and through the wedge-like Bone upon the *Uvula*, *Fauces*, &c. but according to the new, is absorbed again by the Veins and descends by the Jugulars to the Heart.

CHAP. VI.

Of the Cerebellum, and the fourth Ventricle.

THE second part of the Brain is called *Cerebellum*, or the little Brain.

Its seat.

It is seated in the hinder and lower part of the Head or Skull, and is separated from the *Cerebrum* by the two Membranes wherewith it is wrapped, namely the *Dura* and *Pia mater*.

Substance.

It differeth not much from the Brain properly so called, saving that it is harder. It does not run in such windings as the Brain, but its substance is made up of *Lamella* or Plates that lie one upon another, and are each kept apart from other by the *Pia mater*, that invests each one singly, and is much interwoven with Arteries. Within, it is very white, but outwardly more dusky or greyish.

Parts.

It is framed of four parts, whereof two are lateral, the right and the left: these are spherical. Two are in the middle; to wit, the foremost and hindmost: these are round, and are framed of sundry orbicular portions; which because they are like unto the Worms that are in rotten Timber, are called *Processus vermiformes*, or worm-like processes.

Processus vermiformes.

The

The one is in the fore-part of the fourth Ventricle; the other in the hinder part.

The use of the *Cerebellum* seems to be the same Use. as of the Brain. Only Dr. *Willis* not content with this general opinion, distinguishes their uses: writing that in the Brain are elaborated those spirits that perform voluntary motion, and in the *Cerebellum* those that assist natural, as that of the Heart, &c. But against this new hypothesis of his, lie many objections; as first, that Fowl have no *Cerebellum*, and yet their Heart, &c. moves. Secondly, The motion of the Heart, &c. called natural, depends at least partly on the Animal spirits brought by the *par vagum*, which arise out of the *Medulla oblongata*, and therefore one cannot easily conceive how they should receive spirits from the *Cerebellum*; or if they did, why thirdly, not only the natural motion of the Heart should be performed by the said pair of Nerves, but voluntary motions also, as those of the *Larynx*, &c.

Between the lower part of the *Cerebellum* and the *Crura* or roots of the *Medulla oblongata*, is the fourth Ventricle formed. This is commonly called the noble Ventricle, from an opinion that the Animal spirits are elaborated unto perfection herein, as they were prepared in the three other. But as we have assigned other uses to the other, in the foregoing Chapter; so we cannot grant any such office to this, as shall be further shewed in the eighth Chapter. Its lower part that runs in betwixt the forked roots of the *Medulla oblongata*, from its shape, ending in a point, is called *Calamus scriptorius*, or a Writing pen.

The fourth
ventricle.

CHAP. VII.

Of the Medulla oblongata and Spinalis.

Its name.

NOW followeth the third part of the Brain, called *Medulla oblongata* within the Brain, and assoon as it is descended out of it into the Spine, *Spinalis*, or *Dorsalis medulla*.

Substance.

The substance of it is fibrous, being composed of many slender long Filaments, which whether they are hollow or no, cannot be discovered through their fineness.

Parts.

It hath two parts; *viz.* that which is contained within the Brain, and that which is included within the *vertebra* of the Back-bone, or Spine. That which is within the Skull is about four inches in length. That which is without, and beginneth at the great hole of the *Occiput*, reacheth to the *Coccyx*, growing smaller and smaller in the *Os sacrum* towards its end.

Vessels.

If one cut through its substance, there will innumerable little specks or sprinklings of Blood appear, but the Vessels are so small, that they cannot be discern'd. But there are plainly discoverable very many twigs of Arteries and Veins running through the Membranes that invest it; from which Arteries the Blood is infus'd into the pores of the *Medulla*, as it is imbib'd again from thence by the Veins.

Rise.

It seems not to be a separate part from the Brain, but rather a production of it and the *Cerebellum* together, out of both which it seems to rise by six roots; the two uppermost and foremost are

are the most considerable, and are called *Corpora striata*, being the ends of its two *Crua*, by which it is joined to the Brain; the four lower and backer are the protuberances of the *Nates* and *Testes*, by which it adheres more to the *Cerebellum*.

It hath three Membranes. The first is that which immediately toucheth it. This springeth from the *Pia mater*, and passeth between both the parts of it, alone without the outer. The twigs of Arteries and Veins run mostly through this. The second covereth the first, and springeth from the *Dura mater*. There is no distance between them, as there is in the Brain, but one toucheth another being knit together by Fibres. The third proceeding from the Ligament which joineth together the *Vertebra*, covereth both these.

It is divided all along from the very first meeting of its *Crua* within the Skull, to the end of *Os sacrum*, by a membranous partition parting it into two; but this division is not apparent in the Spine, because of the *Dura mater* that covers it; but it may be discovered if that be taken off, and the *Medulla* severed in the middle. The partition is made of the *Pia mater*, and by means of it is that the use or motion of one side only is sometimes taken away in the Palsie.

From this *Medulla* within and without the Brain proceed all the Nerves of the whole Body.

CHAP. VIII.

Of the Processus mammillares.

TReating above of the two lateral *Sinus* of the Brain, we said they descended forwards to the two *Processus mammillares*, which we shall now describe.

Their name They are called *Mammillares* or *Papillares*, because in their end they are round like the Nipple of a Woman's Breast. But they are hollow within and pretty full of moisture.

Rise. Anatomists are not agreed from whence their rise is, some affirming it to be from the Brain, others from the *Crura* of the *Medulla oblongata*, amongst whom *Dr. Willis* is a leading Man. From which soever it is, they proceed as far forwards as the sieve-like Bone, seated at the top of the Nostrils.

Use. *Dr. Willis* takes them to be truly the smelling Nerves, and calls them the first pair. He says they are very marrowy and soft, till they come to the *Os cribriforme*, but then they borrow Coats of the *Dura mater*, with which being divided into many Fibres and Filaments, and passing through the holes of the said Bone, they go out of the Skull: whence being carried into the Caverns of the Nostrils, they are distributed all through the Membrane that invests them. Yet besides this use of smelling, he thinks they may destil some of their moisture into the Nostrils through the holes of the *Os cribriforme* by the duct of the Fibres and Filaments. *Diemerbroeck* thinks they have

have only this latter use ; only that the Rheum
 or *Lympha* destils from them as well upon the *Fau-*
ces and their Glands , as into the Nostrils.
 Dr. *Lower* grants only the former use ; and says,
 “ that It is incredible that the humour that is
 “ contained in the cavity of these processes should
 “ issue out by the Nerves into the Nostrils, for if
 “ it did, the sense of Smelling must needs be much
 “ prejudic’d thereby. And besides, if this water
 “ could destil by and out of the Nerves, much
 “ more might the spirits, that are thinner and
 “ more subtil, fly away. And as to the humour
 “ contained in the cavity of the processes , he
 “ supposes it to be of very great use : namely,
 “ that when *Effluvia* or most subtil particles ex-
 “ haling from an external object are delivered to
 “ the *olfactory Nerves* , that their species may
 “ reach the Brain the better , it was necessary
 “ that those Nerves or *Processes* should be made
 “ hollow from their very rise, and be filled with a
 “ limpid humour : Not that I believe, says he,
 “ that the species themselves are conveyed
 “ through their cavities into the ventricles of the
 “ Brain, or that the Animal spirits are lodged in
 “ those Ventricles , as the Ancients thought ;
 “ but that they are therefore hollow and moisten’d
 “ within with water, that their marrowy bodies
 “ may serve the better both for retaining and
 “ conveying smells into the Brain : For as things
 “ smelled are better perceived from moist bodies
 “ and in a moist Air than in a dry season from the
 “ parched ground (as Huntsmen know too well)
 “ so it is likely that in the same manner as they
 “ are best perceiv’d outwardly, they are also best
 “ conveyed inwardly, &c.] And indeed if we

will allow them to be olfactory Nerves, it is very incongruous that they should serve for an Emunctory to the Brain, to discharge its superfluous *Serum*. And therefore we think it fit to acquiesce in this learned Physicians opinion : and to believe that the *Lympha* gathered in the ventricles of the Brain is emptied by those ways we before observed out of the same Author, and not at all by the nervous Filaments that pass from these processes through the *Os cribriforme* into the Nostriils.

CHAP. IX.

Of the Action of the Brain, and the supposed Succus nutritius of the Nerves.

IT is generally agreed that the proper Action of the Brain (in a large sense) is the elaborating of Animal spirits; and that they are sent from it by the Nerves into the several parts of the Body, for performing both natural and animal actions. But what these Animal spirits are, and in what particular part of the Brain they are generated, is not agreed upon by learned Men.

The animal spirits what, and of what made.

Some are of opinion that the Animal spirits differ in no other regard from the Vital, but only as they are conveyed by proper Vessels, and minister to other purposes, and are of a cooler temperament; but that there is no specifical difference betwixt them. Others on the other side think they differ *in specie*, and agree in nothing, but only that the Vital spirits and Blood are the matter

matter from whence the Animal spirits are formed. A third sort deny the Arterial blood to be the matter of these Spirits, and affirm that the Nerves absorb a part of the Chyle, of which they are made, and besides, a Nutritious juice, (of which by and by.) And some there are that suppose Air also to be an Ingredient, which ascends into the Brain through the *Os cribriforme*. We cannot stand upon the examination and refutation of several of these opinions here ; but upon a due consideration of the Arguments urged for each , we think that the Animal spirits are specifically distinct from the Vital, but that the Vital, with the Arterial blood, their Vehicle, are the true and only matter, out of which they are elaborated.

And there is no less difference in what part of the Brain the Animal spirits are made. Some thinking in the *Sinus* of the *Falx*. others the four ventricles of the Brain, especially the fourth, a third sort the *Plexus choroides* and *Rete mirabile* ; *des Cartes*, that they are separated out of the Arteries of *Plexus choroides* in the *Glandula pinealis* into the Ventricles ; and others lastly assign the whole substance of the Brain for the place of their confection. As to the *Sinus* of the *Falx*, the use of that was shewn above Chap. 3. And as to the Ventricles, seeing they are often almost quite full of waterish humour, but always have some, they seem very unfit for the making or receiving such subtil and volatile Spirits as the Animal are. As for the *Plexus choroides* and *Rete mirabile*, there is no Vessel in either that contains any thing, but under the form of Blood ; so that seeing there are no *Vasa deferentia* (or call them what you will) to convey the Spirits to the origine of the Nerves, these

these also seem improper for such an action. We must therefore subscribe to the last opinion that ascribes this work to the very substance of the Brain, and is performed in this manner. The Heart is like the *Primum mobile* of the Body, to which the motion of all the humours, that have once past it, is owing. This by its *Systole* impells the Blood, as into all other parts, so into the Brain by the several branches of the *Carotides*, whose innumerable twigs run partly through the outer *Cortex* or greyish part of the Brain, and partly into the inner medullar or white substance. These twigs of Arteries spring partly from the *Plexus choroides* and *Rete mirabile*, and partly from the *Carotides* themselves immediately. The superfluous *Serum* of the Blood is separated by the Glands above described; and that which is not elaborated into Animal spirit, is returned again to the Heart, by the Veins. But those particles that are fit and proper to be converted into them, are extravasated into the very *Parenchyma* of the Brain, or at least are distributed through it by invisible Capillaries, in which being perfected into Spirits, these by help of the Fibres or Filaments which the inner substance of the Brain chiefly consists of, are conveyed to the *Corpora striata* (or other processes of the *Medulla oblongata* that adhere to the Brain) which consist of the like Filaments, and by them to the Nerves, whose inner substance is fibrous like the *Medulla* from whence they spring. And the reason of this successive motion from one to another, is the Pulse of the Heart, whereby that which comes behind, always drives forward what is before. Whence the true cause of an Apoplexy (wherein motion

and

and sense are almost quite abolisht) is from the obstruction or compression, &c. of the Arteries in the Brain; whereby both little Blood and Vital spirit can be conveyed thither to make Animal spirit of, and also when it is made, it is not impelled out of the Brain along the Fibres into the Nerves, to enable them to perform their functions.

There is no less controversie about the Nutritious juice of the Nerves: some contending for it to that height, as to affirm that all the parts of the Body are only nourish'd by it, and not at all by the Blood, which by its rapid motion they say is liker to wear and carry away something from the parts through which it passes, than to adhere to them for their restauration. Others are more moderate, and suppose that nourishment is dispensed only to the spermatick parts by the Nerves, which the Nerves receive not from the Blood, but imbibing the most thin part of the Chyle out of the Stomach and Guts do carry it up to the Brain, from whence it is conveyed again by the same Nerves to the parts to be nourish'd by it. *Diemerbroeck* is of opinion, that the juice of the Nerves (which is as a Vehicle to the Spirits) being somewhat acid, does contribute or yield assistance to the nourishment of the spermatick parts, not as it is the matter of, but as it separates from the Blood such particles as are fit for, their nourishment. Whence it is, he says, that such parts of the Body as are most exercised, and by consequent into which most Animal spirits flow, grow the strongest, having more of such particles of the Blood as are fit for their instauration, separated in them. So they that are used

*The succus
nutritius
of the
Nerves.*

to walk, will endure it better, than others that are not so used, though otherwise much stronger. And hence the right Arm is usually stronger than the left, in those that are right-handed (as we say.) But he thinks that the Nerves have no juice in them which they did not first receive from the Blood. Dr. *Willis* is much of his opinion, saying as to this last particular; for he says, it is without doubt that the nervous Fibres and Filaments which cloath the sensory of the taste, and the Bowels that serve concoction, do immediately take some taste of the Aliments for the supply of the Brain, especially at such times as the Spirits are much wasted in too long fasting or over much exercise. But then that juice that may be supposed to be made thereof in the Brain, and to be dispensed by the Nerves into all the parts of the Body, he believes not to be the matter of the nourishment of any part whether spermatick or sanguineous: but that it is as the *form* only, and the Blood the *matter*, whose several particles being analysed or severed by the said juice, are directed and adapted by its *directive faculty* or *plastic power* as it were, to such parts respectively as they are suitable for. And from hence he draws a reason why paralytick parts do waste so much, though the Blood flow plentifully enough into them, because the Nerves being obstructed and no Animal spirits (with their Vehicle) passing by them, the particles of the Blood are not separated for the supply of such parts.] As for the nervous juice, it must needs be very little in quantity, seeing if one make a Ligature upon the Nerve, it will not swell betwixt the Head and Ligature, nor if one cut the Nerve in sunder will any

any thing destil out of it. So that 'tis very absurd to think that it should be sufficient for the nourishment of all the parts of the Body, according to the first opinion. Nor does it seem reasonable to imagine that the Chyle should ascend from the Stomach, &c. to the Brain by the Nerves, whiles this nervous juice that is contended for, with the Animal spirits, is descending by the same; for one cannot conceive how such contrary motions of liquors in the same Vessel can be at the same time. Though from the sudden refection that persons ready to faint receive from spirituous liquors, &c. it be probable that certain *Effluvia* or subtil and spirituous vapours do enter the nervous filaments of the Mouth and Stomach, and recruit the Animal spirits immediately, without fetching that compass that I believe all the Chyle does. And as the Nerves imbibe no Chyle from the Stomach, &c. so receive they no more from the Arteries, than some of its most spirituous and volatile particles elaborated in the Brain into Animal spirits, which have indeed some little moisture accompanying them as a Vehicle, but which is neither of a suitable nature nor of proportionable quantity for the nourishment even of the spermatick parts only. For seeing the Nerves have no conspicuous Cavity, but only imperceptible Pores, by which any liquor can drill along them; such liquor must needs be most thin and watery, and therefore unfit to be assimilated to any part. And lastly, as to the opinion that it separates the particles of the Blood, and so distributes those that are respectively proper for, unto, each part, as the sulphureous to the fat, &c. or is to the Blood as the form is to the matter;

matter ; it is an ingenious hypothesis I confess, but whether true, I dare not affirm.

CHAP. X.

Of the Nerves arising within the Skull, and first of the first and second pair.

SO much of the substance of the Brain and of the Animal spirits, &c. It follows that we shew the Nerves which proceed from it. Of them there have been reckoned seven pair, comprehended in these Verses :

*Optica prima ; oculos movet altera ; tertia gustat :
Quarta, & quinta audit ; vaga sexta ; at septima
lingua est.*

But assenting to Dr. Willis, that most accurate describer of them, who holds the *Processus mammillares* to be the olfactory Nerves, and the *Par vagum* and *Intercostale* to be two distinct pairs, we reckon nine in all : of the two first of which in this Chapter.

Nervio-
factorii,
the first
pair.

Of all the pairs of Nerves that rise within the Skull, the olfactory or smelling pair are the first, otherwise called *Processus mammillares*. They spring from the *Crura* of the *Medulla oblongata* betwixt the *Corpora striata* and the little hillocks or eminences out of which the optick Nerves rise (called by Galen, their *Thalami*.) Though *Diemerbroeck*, that denies them to be Nerves, affirms that

that they spring not from the said *Medulla*, but from the globous marrow of the Brain (properly so called) and its fore Ventricles. But having discoursed of these in a particular Chapter, (*viz.* Chap. 8.) we shall adde no more of them here.

The second pair the *Optici* or *Visorii nervi* Nervi optici, the second pair. make; these bestow upon the Eyes the faculty of seeing. They spring from the *Crura* or Trunks of the *Oblongata medulla* behind the *Corpora striata*, as was noted in the foregoing Paragraph. They march on from thence drawing nearer one to another, untill they meet at the *sella* of *Os sphenoides*; where they are united by the closest conjunction, but not confusion of their Fibres, which run lengthways in these Nerves as they do in all other. These of all the rest are biggest and thickest, but softest. In their beginnings they are softest, but in their progress become harder, that they may pass the more securely so long a way. Dr. *Wilks* says they have many Fibres from the third pair of Nerves, and many sanguiferous vessels running along them.

They are hollow untill they be united; but after, their hollowness cannot be discerned. This The hollowness of the optick Nerves. hollowness may be shewed in a large Beast newly killed, and in a clear light.

After their union they are separated again, Their in- and each of them, passing through the first hole section. of *Os cuneiforme*, are inserted obliquely into the centre of the Eye.

These Nerves have two Membranes, and the inner soft marrowy substance, or Fibres. Their membranes and marrowy substance. The Membranes spring from the two *Meninges*. The inner substance from the *Medulla oblongata*.

From

*These make
the tunicles
of the Eyes.*

From the whole substance of these Nerves are the Tunicles of the Eyes framed; for the *Cornea* or *Sclerotica* doth proceed from the thick Membrane or *Dura mater*, the *Uvea* from the thin Membrane or *Pia mater*, and the *Retina* from the marrowy substance.

CHAP. XI.

Of the third and fourth Pair.

*The third
pair.
Its begin-
ning.*

THE third pair is termed *Motorium oculorum*, because it moveth the Muscles of the Eyes. It hath its beginning at the innermost part or *basis* of the *Medulla oblongata* behind the *Infundibulum*.

*Why both
the Eyes
are direct-
ed to the
same object.
Its sub-
stance, and
branches.*

This pair is united at its rise; whence is commonly drawn a reason why one Eye being moved towards any object, the other is directed also to the same.

It is smaller and harder than the former, and being presently divided passes along by the optick pair, and penetrating the second hole of *Os cuneiforme*, is carried towards the globe of the Eye, where it is divided into four branches. The first whereof mounting above the Optick, is bestowed upon the attollent Muscle, and the Eyelid. The second easie to be seen is bestowed upon the adducent Muscles by sundry small twigs. The third by many Fibres is inserted into the deprimment Muscle. The fourth is inserted into the middle of that Muscle that draws about the Eye obliquely

obliquely downwards to the inner corner. So that this pair only moveth four Muscles.

The fourth pair proceedeth from the top of the *Medulla oblongata*, (contrary to all others, which arise either from its *basis*, or sides) behind the round protuberances called *Nates* and *Testes*: whence bending forwards by the sides of the *Medulla oblongata*, it presently hides it self under the *Dura mater*; under which proceeding awhile, it passes out of the Skull at the same hole with the others designed for the Eyes, (communicating with no other Nerve in its whole progress) and is bestowed wholly (as Dr. *Willis* affirms) on that Muscle of the Eye called *Trochlearis*. *The fourth pair. Its beginning, marching, and insertion.*

CHAP. XII.

Of the fifth, sixth, and seventh Pair.

THE Author last mentioned says, the fifth pair arises out of the sides of the annular process jetting out from the *Cerebellum*: but I think it is more probably affirmed by others, that this pair arises also from the *Medulla oblongata* a little below the former Nerves. Its trunk is very large, consisting of very many Fibres, some soft and some hard: so that it seems to be not one single Nerve, but a collection or bundle of many small ones, some of which are designed for one part, some for another; some serving for motion and others for sense. And the reason why they *The fifth pair. Its rise.*

they are all united together in their rise, Dr. Willis thinks to be, that there may be a sympathy and consent of actions in the several parts to which they are distributed. Hence it is that seeing or smelling what is pleasing to the appetite makes ones Mouth water, &c.

Division
and pro-
gress.

Its Trunk is divided into *two* notable branches, sometimes before but oftner after it has penetrated the *Dura mater*. The *first* whereof tending streight downwards, and passing out of the Skull by its proper hole, in its descent towards the lower Jaw (for whose parts 'tis chiefly design'd) is divided into many lesser branches, which provide for the temporal Muscle, as also for the Muscles of the Face and Cheeks. From these also there go twigs to the Lips, Gums, roots of the Teeth, *Fauces*, Tonsils, Palate and Tongue. The *second* branch of this fifth pair, being the larger, goes a little streight forward by the sides of the *sella Turcica*, and over against the *Glandula pituitaria* sends little twigs to the trunk of the *Carotides*; then inosculates with the Nerve of the sixth pair, and afterward sends back a slip or two, which being united with another slip returned from the Nerve of the sixth pair constitute the trunk of the *Intercostal pair*, which we shall reckon for the ninth, and speak of it by and by. After this it is divided into *two* notable branches; The *left and upper* whereof tends towards the globe of the Eye, and being again divided sends forth two other, the first of which is parted into two more, that go one to the Nose and the other to the Eye-lids; and the second into four or five slips, that are mostly spent on the Eye-lids, but partly on the *Uvea tunica* and the Glands of the Eye.

Eye. The *greater branch* (of its second division) being carried towards the orbit of the Eye is divided into two new branches. The *lower* whereof bending downwards is bestowed on the Palate and upper region of the *Fauces*; and the *upper* being carried beyond the orbit of the Eye passes through an hole of the upper Jaw with the Vein and Artery which it twists about, and sends many slips to the Muscles of the Cheeks, Lips, Nose, and roots of the upper Teeth. From its twisting about the sanguiferous vessels designed for the Cheeks and other parts of the Face, may a reason be drawn why one blushes when he's ashamed: for the Animal spirits being disturbed by the imagination of some uncomely thing, as if they took care to hide the Face, enter this Nerve disorderly; so that its twigs embracing these sanguiferous vessels, by compressing and pulling of them, cause the Blood to flow too impetuously into the Cheeks and Face by the Arteries, and detain it there some time by constringing the Veins.

The *sixth* pair rises just by the fifth, and presently sinking under the *Dura mater* goes out of the Skull by the same hole with the Nerves of the third and fourth pair, and is carried by a single trunk towards the orbit of the Eye; but so, as by the side of the *sella Turcica* it inosculates with the second or greater branch of the fifth pair, (as was noted in the former paragraph:) whence sending back sometimes one, sometimes two twigs, these being united with the recurring twigs of the fifth pair (above-mentioned) make the beginning of the *Intercostal nerve*. Afterwards going forwards, near the orbit of the Eye it is divided into two branches; of which *one* is inserted

*The sixth pair.
Its rise and insertion.*

ted into the abducent Muscle of the Eye placed in its outer corner; and the *other* being cleft into many Fibres is bestowed on the seventh Muscle proper to Brutes, whereby they defend the Eye from external injuries without closing the Eye-lids, when they are said *nictitare*, which I think we have no word to express in English.

*The seventh
pair.
Its rise and
insertion.*

The *seventh* pair, by the Ancients commonly reckon'd for the fifth, ministers to the sense of Hearing. It has two Processes, one soft, and the other harder, which might seem to be two distinct pairs, but are usually accounted one. They have been held to spring from the sides of the *Medulla oblongata*, but Dr. Willis says (I cannot tell how truly) from the annular protuberance of the *Cerebellum* that lies by the sides of the said *Medulla*. The *soft* part or process that is properly the auditory Nerve, is carryed through an hole of *Os petrosum* into the caverns of the Ear, which it cloaths with a most thin Membrane. By this are sounds conveyed to the common sensory. The *harder* process serves rather for motion than sense; which passing out also through its proper hole, presently admits a twig from the *par vagum* or eighth pair, after which it is immediately divided into *two* branches; *one* whereof tending downwards, is bestowed on the Muscles of the Tongue and *Os hyoides*; and the *other* winding about the auditory passage, and bending upwards, is divided into three twigs; of which the *first* corresponding to the Nerve of the first division bestows certain slips on the Muscles of the Lips, Mouth, Face and Nose, and so actuates some outward organs of the Voice, as the former some of the inner; the *second* is distributed to the Muscles
of

of the Eye-lids and Forehead, and the third on the Muscles of the Ears. Whence upon some unusual and astonishing sound, by a certain natural instinct the Ears prick up and the Eyes open.

CHAP. XIII.

Of the eighth and ninth Pairs.

THE next pair in order is the *eighth*, which has used to be called the sixth, and *par vagum*, or wandering pair, from its being distributed to sundry parts.

It springs below the auditory Nerves, out of the sides of the *Medulla oblongata*, its root consisting of twelve Fibres at least (in Man) to which a notable Fibre, or rather Nerve (much greater than any of these twelve) coming from the spinal marrow about the sixth or seventh vertebra of the Neck, is joined, and invested with the same Coat from the *Dura mater* as if they grew into one Nerve; but if their common Coat be removed, this accessory Nerve, and many of the other Fibres remain still distinct, and after they are gone out of the Skull together, are dispensed to several parts; the accessory Nerve to the Muscles of the Neck and Shoulder; and one notable Fibre of the eighth pair to the harder process of the Auditory or seventh pair, as also two others to the Muscles of the Gullet and Neck. But the other Fibres of this *par vagum* continue united, and instead of those companions they

have parted with, they entertain a new one, namely a branch from the Intercoſtal or ninth pair, whereby is made a notable *Plexus* (which in a Nerve is like the jointing of a Cane, or the knot upon the trunk of the Tree where a Bough goes out) and out of the ſame *Plexus* there ſprings a conſiderable branch, which being carried toward the *Larynx* is divided into three twigs, of which one goes to the ſphincter of the Gullet, a ſecond to the upper Muſcles of the *Larynx*, and the third going under the *Cartilago ſcutiformis*, meets the top of the recurring Nerve and is united to it.

Progreſs. Below the aforeſaid *Plexus* of this *par vagum*, its trunk goes ſtreight down by the ſide of the aſcending *Carotides*, on which it beſtows ſome ſlips. And at the bottom of the Neck it receives a ſecond branch from the Intercoſtal, (*viz.* from its firſt *Plexus*) and near thereto ſends out another twig into the recurrent Nerve, but only on the left ſide. From hence the trunk of this eighth pair deſcends without any notable ramification, till it be come over againſt the firſt or ſecond Rib; where out of a ſecond *Plexus* (or knot) many twigs and Fibres go towards the Heart and its appendage, but not altogether in the ſame manner on both ſides. There is one notable difference (which we cannot but note) of the two *recurring Nerves* that ſpring out of the trunk of this eighth pair, *viz.* that that on the right ſide ariſes out of it higher and windes about the axillar Artery; whereas that on the left ſprings much lower therefrom, and twiſting about the deſcending trunk of the *Aorta* returns back from thence. Dr. *Willis* ſays that the *recurring Nerve* is really a diſtinct Nerve from the *par vagum* from the very original,

original, and was only included in the same case or cover for the more convenient and safe passage. The branches of the *par vagum* do frequently unite with others of the Intercostal pair about the *Præcordia*. And many twigs go out of the eighth pair into the Lungs, &c. Whence each of its trunks descending by the sides of the Gullet are divided into two branches, *outer* and *inner*: The outer unite with the outer, and the inner with the inner, and both descend to the Stomach, in which they terminate. As for their more particular distribution, we have spoke thereof while we treated of the parts themselves on which they are bestowed.

We are now come to the *ninth* or last pair *The ninth* (commonly not distinguished from that going *pair* before) which is called the *Intercostal*, because as it marches down by the roots of the Ribs, betwixt every Rib it receives a branch from the spinal marrow. It has no proper root of its own, but *its rise*, its trunk is compounded of two or three recurring branches of the fifth and sixth pair, (near their origine) as was noted when we treated of those pairs. Being thus formed it passes out of the Skull by its proper hole, and presently has a *Plexus* near that of the *par vagum*, into which two nervous processes out of the first vertebral pair are inserted, and out of which there goes a twig into the sphincter of the Gullet, and into the *Plexus* (aforesaid) of the *par vagum*. Whence descending by the *vertebra* of the Neck, by that time it arrives at its middle, it has another greater *Plexus*, into which a large Nerve from a neighbouring vertebral pair is inserted; and

from which proceed many twigs that uniting with others of the *par vagum* are distributed all about the *Præcordia*, as also one single one a little lower. This *Plexus cervicalis* out of which so many branches spring is proper to Man, being not found in Brutes. From the Neck it descends by the *Clavicula* into the *Thorax*, where having arrived at the second Rib it receives three or four branches from the vertebral Nerves next above, whereby is made another notable *Plexus* (commonly called the *Intercostal*.) From whence as its trunk passes down by the roots of the Ribs, in every one of their Interstices and even as low as *Os sacrum*, from every jointing of the *vertebra* it receives a vertebral pair. As soon as it is descended out of the cavity of the Breast, and is come over against the Stomach, it sends forth on each side a notable branch, which tending towards the Mesentery, make its chief *Plexus*, which are in number seven, five large ones which are upper, and two less that are lower. For each branch is presently divided into two other, and every one forms one *Plexus*, which make four; and the fifth is in the middle of these, being the largest, and like the Sun amongst the Planets (as Dr. *Willis* compares it.) And these are the five upper. The two lower are framed of branches that spring from the trunk descended as far as the lower part of the Loins, and are distinguished by the names of *Plexus Infermus*, and *Minimus*. As to the parts that all the twigs which spring from these seven *Plexus* are distributed to, it may be learned from the description of the parts themselves in the first Book, in which we constantly mentioned from whence each part had its Nerves. Lastly when this *Intercostal*
pair

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Fig. 1.

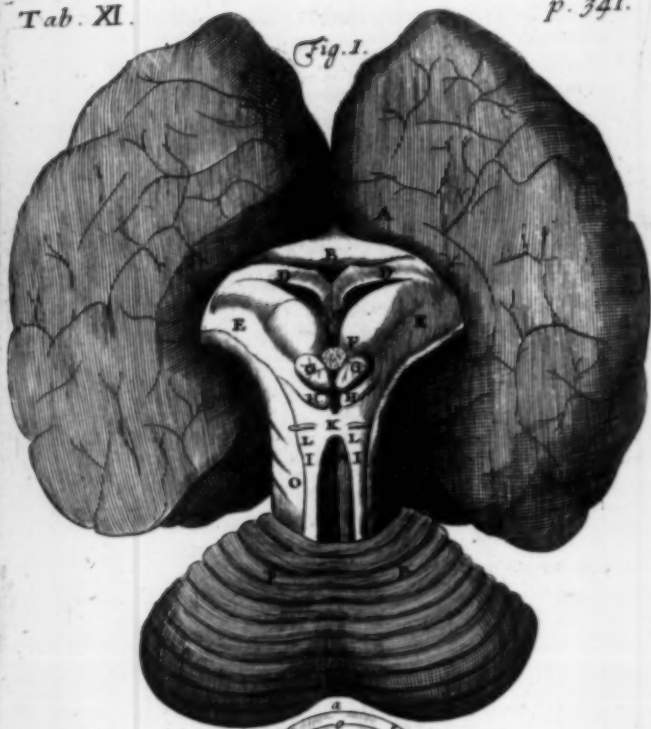


Fig. 2.



pair is come to the *Os sacrum*, its two trunks bend towards each other, and seem to be knit together by two or three processes, and at length each of them ends in small Fibres that are distributed into the sphincter of the *Anus*.

And thus we have done with all the Nerves that proceed from the *Medulla* within the Brain, in describing of which we have followed *Dr. Willis* for the most part, that most accurate tracer of them.

The Explanation of the Table.

Figure I.

Representeth the outer or upper superficies of the Brain taken out of the Skull; where the *Limbus* of the Brain being loosed from its coherence with other parts by Membranes, is lifted up and bent forwards, that the *Crura* of the *Medulla oblongata*, the *Fornix*, *Nates* and *Testes* with the *Glandula pinealis*, and other processes may be clearly and distinctly seen, (from *Dr. Willis*.)

AA The *Limbus* of the Brain, which in its natural situation was contiguous to the *Cerebellum*.

B The border or margin of the *Corpus callosum* spread over both hemispheres of the Brain, which in its natural situation lay upon the *Glandula pinealis*.

C The *Fornix*.

DD Its Arms embracing the *Crura* of the *Medulla oblongata*.

EE The *Crura* of the *Medulla oblongata*, (out of which

The ANATOMY

which the optick Nerves proceed) whose ends (being placed further, out of sight) are called Corpora striata.

F The Glandula pinealis, betwixt which and the root of the Fornix is the chink that leads to the Infundibulum.

GG The orbicular protuberances called Nates.

HH The lesser protuberances called Testes, which are processes of the former.

II The Medullary processes, which ascend obliquely from the Testes to the Cerebellum, and make a part of each of its Meditullia.

K The joining of those processes by another transverse process.

L The rise of the pathetick Nerves (or fourth pair) out of the joining of the foresaid processes.

MM A portion of the Medulla oblongata lying under the foresaid processes and protuberances.

N The Foramen of the Ventricle or Cavity that lies under the orbicular protuberances.

OO A portion of the annular protuberance let down from the Cerebellum and embracing the Medulla oblongata.

PP The outer and upper superficies of the Cerebellum.

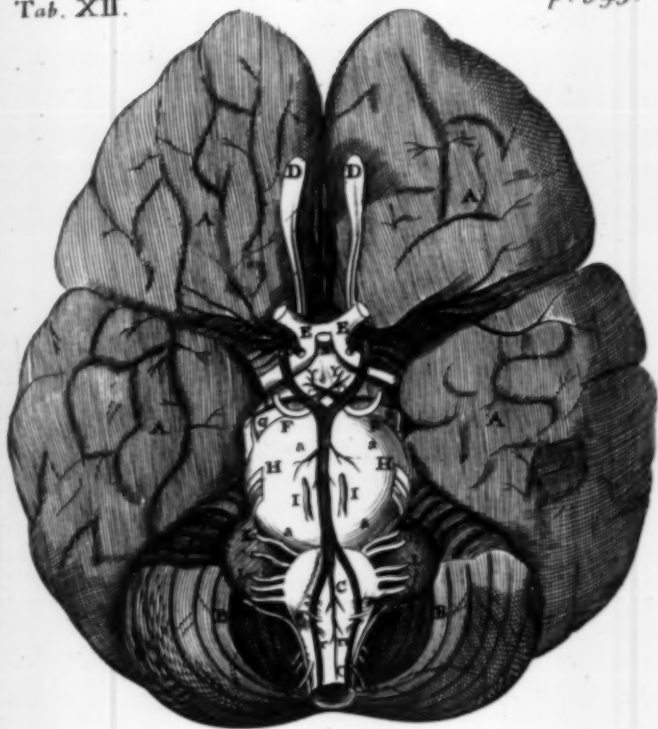
Figure II.

Representeth the Eye cleft in two (from behind forwards) that the divers situations of the humours may appear, (from Dr. Briggs.)

bab The Tunica cornea, or fore and more convex arch of the Eye.

ee The Tunica uvea (whose Foramen o is called the

d
n-
ss
ed
the



- the Pupilla) swimming in the watry humour cccc.
d The crystalline humour in situ.
ff The Tunica choroides, which in this Figure
(as being too much separated from the Sclero-
tica m m) cannot be duly represented.
g A portion of the Optick Nerve.
h Some of its small Fibres cut off near the exit of the
Nerve.
I The centre of the Humor Vitreus, and of the
Retina.
1, 2, 3, 4, 5, &c. The Capillamenta of the optick
Nerve, whose ends on each side being cut off did
adhere to the Ligamentum ciliare (namely by
the region of the crystalline humour.)

The Table

Representeth the basis of an humane Brain taken
out of the Skull, with the roots of the Vessels
cut off short, (from Dr. Willis.)

- AAAA The fore and hinder Lobes of the Brain.
BB The Cerebellum.
CC The Medulla oblongata.
DD The olfactory Nerves, or first pair.
EE The optick Nerves, or second pair.
FF The motory Nerves of the Eyes, or third pair.
GG The pathetick Nerves of the Eyes, or fourth pair.
HH The fifth pair.
II The sixth pair.
KK kk The auditory Nerves, and their two Proces-
ses on each side, the seventh pair.
LL lll, &c. The Par vagum or eighth pair, consist-
ing of several Fibres.

- MM *The spinal Nerve coming from a far to the origine of the Par vagum.*
- NN *The ninth or Intercostal pair, consisting also of many Fibres (that tending downwards, unite into one trunk) which emerges a little above the process of the Occiput.*
- OO *The tenth pair tending downwards.*
- PP *The trunk of the Carotid Artery cut off, where it is divided into the fore and hinder branch.*
- QQ *Its branch passing betwixt the two lobes of the Brain.*
- R *The fore branches of the Carotides, being united, part again and proceed to the fissure of the Brain.*
- S *The hinder branches of the Carotides united, and meeting the vertebral trunk.*
- TTT *The vertebral Arteries, and their three ascending branches.*
- U *The branches of the vertebral Arteries uniting into the same trunk.*
- WW *The place where the vertebral and Carotid Arteries are united, and a branch on either side ascends to the Plexus choroides.*
- X *The Infundibulum.*
- YY *Two Glands placed behind the Infundibulum.*
- aaaa *The annular protuberance which proceeding from the Cerebellum embraces the root of the Medulla oblongata.*

CHAP. XIV.

*Of the Nerves of the Spinalis medulla ; and
first of the Nerves of the Neck.*

WE observed above, Chap. 7. that the *Medulla oblongata* seemed not to be any separate part, but only a production from the *Cerebrum* and *Cerebellum* : and that when it is descended out of the Skull into the Spine, it loses its name of *oblongata*, and acquires that of *Spinalis*, which name it borrows from the Spine through which it passes, but is of the same fibrous or filamentous substance as it was within the Brain. And now we come to describe the Nerves that spring out of it, which assist the motion of all those parts, which those nine pair already described that arise within the Skull, reach not to.

In its whole progress from the Skull to the *Nerves Coccyx*, there spring out of it thirty pair of *springing* Nerves : seven of which are of the Neck, twelve *from the* of the Breast, five of the Loins, and six from the *Spinalis medulla*, holes of *Os sacrum*.

The first and second pair of the Neck come not out of the sides of the *Vertebra*, as all the rest do ; but because of their peculiar articulation spring out before and behind.

The *fore* Nerve of the first pair cometh out between the bone of the *Occiput* and the first *vertebra* *Seven of the Neck*, and is bestowed upon the Muscles *The first* which bend the Neck, and lie under the *Oesophagus* *pair*.
The *hinder* Nerve cometh out of the hole
which

which is common to the *Os occipitis* and the first *vertebra* of the Neck. This hath two twigs: The smaller is bestowed upon those Muscles which stretch out the Neck; The bigger is inserted into the beginning of the Muscle which lifteth up the Shoulder-blade.

The second. The *fore* Nerve of the second pair (which is smaller) cometh out between the first and second *Vertebra*, and is bestowed upon the Skin of the Face. The *hinder* cometh out at the sides of the hinder process of the second *Vertebra*, but presently is parted into two twigs. The thicker of which is bestowed upon the whole Skin of the Head even to the Crown; The smaller upon the greater streight, and the lower oblique Muscles which stretch out the Head. Dr. Willis says, that the first and greatest root of the Nerve of the *Diaphragm* ariseth from this second pair of the Neck: of which Nerve we shall speak more by and by.

The third. The third pair cometh out of the *lateral* holes, which are between the second and third *Vertebra*, and each is immediately divided into two branches; the *formore* whereof hath four twigs: The first cometh to the long Muscle or the first of the benders of the Neck; The second descending is bestowed upon the Muscles which lie under the *Oesophagus*, being first united to a twig of the fourth pair; The third ascending goeth to the Skin of the back-part of the Head, having first joined with the thicker twig of the hinder Nerve of the second pair; The fourth is bestowed upon the transverse Muscles of the Neck, and the Muscle which lifteth up the Shoulder-blade. The *hinder* branch is bestowed upon the second pair of Muscles

Muscles which heaveth up or wideneth the Breast.

The fourth pair cometh out of the holes common to the third and fourth *Vertebra*, and each hath two branches, like the third pair. The *formore* hath three twigs: The first of which uniting with a twig of the third pair is bestowed on the first of those Muscles which bend the Neck, called *Longus*; The second upon the transverse Muscle of the Neck, and the *Cucullaris* of the Shoulder-blade: The third being slenderer than the other two, is joined with a twig of the fifth pair, and both with one of the sixth, and lastly all three (according to Dr. *Willis*) with that of the second pair above-mentioned: and the Trunk made up of all these descendeth by the sides of the Gullet down the Neck and *Thorax* without any branchings till it come to the Diaphragm, where it is divided again into three or four twigs, on each side, and is inserted into its fleshy or muscular part, being known by the name of *Nervus diaphragmaticus*, or *Phrenicus*. The *hinder* branch goeth back to the Spine under the Muscles of that part, upon which it bestoweth twigs, and going down between the Muscles of each side of the Neck it is carried to the *Musculus quadratus* that draweth the Cheek down.

The fifth pair marcheth out between the fourth and fifth *Vertebra*, and hath likewise two branches on each side. The *formore* of which hath four twigs: The first goeth to those Muscles that bend the Neck: The second is that which joineth with the twigs of the second, fourth and sixth pairs, and makes up the *Nervus phrenicus*: The third goeth to the *Deltoides*: The fourth goeth to the same *Deltoides*, and to the *Coracohyoideus*, or the third

third pair of the Muscles of *Ossuaries*. The *hinder* branch bendeth back to the Spine, and is bestowed upon the Muscles there, as the like branch of the fourth pair was.

The sixth. The sixth pair cometh out under the fifth *Vertebra*, and hath, as the rest, two branches. The *formore* sendeth first one twig to make the trunk of the *Nervus phrenicus*; then proceeding further it is united with the three following, namely the last of the Neck and two first of the *Thorax*, making one *Plexus* with them, out of which those Nerves proceed that are carried to the Arm. The *hinder* branch goeth to the Muscles behind, which stretch out the Neck and Head.

The seventh. The seventh pair cometh out of the hole common to the sixth and seventh *Vertebra*. The *formore* and larger branch is joined with the sixth of the Neck and two first of the *Thorax*, as aforesaid, and is carried to the Arm. The *hinder* and smaller is bestowed upon the Muscles of the Neck, and quadrat Muscle which pulleth down the Cheek.

Nervus ad par vagum accessorius. About where this sixth or seventh pair of Nerves rise, there springeth another, described by Dr. *Willis*, and by him called *Nervus spinalis ad par vagum accessorius*. It rises small out of the side of the spinal marrow, and ascends up by the side of it, growing thicker as it goes, (but without being inserted any where into the marrow) till having enter'd the Skull it is joined to the Fibres of the *par vagum* or eighth pair. Its progress from thence we observed in Chap. 13. when we described the eighth pair.

CHAP. XV.

Of the Nerves of the Vertebrae of the Breast.

FROM the marrow of the *vertebra* of the *Tho-* Twelve of
rax twelve pair spring. In all of which the *the Tho-*
 formore branch is bigger; and the hinder, which *rax.*
 is bestowed upon the Muscles seated in the Back,
 smaller.

The first springeth out of the hole which is *The first*
 common to the seventh *vertebra* of the Neck, and *pair.*
 the first of the Breast, and therefore 'tis indiffe-
 rent whether it be esteemed to belong to the
 Neck or *Thorax*, some reckoning it to be the
 eighth of the Neck, and others (as we do here)
 the first of the Breast. Each Nerve is presently
 divided (as all the rest are) into two branches;
 the *formore* of which is united to the sixth and se-
 venth of the Neck as was noted in the foregoing
 Chapter, and so is all spent on the Arms, except
 one little twig that springing out of its beginning
 marcheth forward towards the *Sternum*, and be-
 stoweth twigs on the *Musculus subclavius*, and
 those Muscles which arise from the top of the
Sternum; and another that goes to that Muscle
 which fills up the hollowneis of the Shoulder-
 blade. The *hinder* branch creeping under the
 Muscles which cleave to the *Vertebra*, is bestowed
 upon the Muscles of the Neck, Head and Shoal-
 der-blade.

The second issueth out of the space between the *The second.*
 first and second *vertebra* of the Breast; and its
fore branch is united with the first of the *Thorax*,
 and

and together with it is joined to the sixth and seventh of the Neck, which all together make one *Plexus* that sendeth forth all the Nerves to the Arms that they have, (as shall be further explained Book 4. Chap. 3.) But besides that branch by which it unites with these, it sends a twig also to the Intercostal nerve (or ninth pair) descending down the *Thorax*, (as also does every one of the remaining ten pair) and from that twig before it join with the Intercostal there proceed small slips to the Muscles that lie upon the Breast. The *hinder* branch hath the same distribution with the hinder of the foregoing pair.

*The rest of
the pairs.*

The rest of the ten pair come out of the lateral holes of the *Vertebrae*, and are all immediately divided into two branches; whereof the *formore* being larger, always sendeth one twig to the Intercostal nerve, and the remainder of it is bestowed on the Intercostal Muscles internal and external, and on those that lie on the *Thorax*; as also on the obliquely descending Muscles of the *Abdomen*, &c. The *hinder* bend backward to the Spine, and are spent upon the Muscles and Skin of the Back.

CHAP. XVI.

Of the Nerves of the Vertebrae of the Loins.

*Five of the
Loins.*

Although there be but four lateral holes in the *vertebrae* of the Loins; yet there are five pair of Nerves. The *fore* branches being greater

greater go to the Muscles of the Belly : The *binder* to those which rest upon the *Vertebra*. The *formore* are joined together, the first with the second, the second with the third, the third with the fourth, and the fourth with the fifth, as the two last of the Neck and two first of the Breast were.

The first cometh out of the lateral hole between the last *vertebra* of the Breast, and the first of the Loins. The *fore* branch is bestowed upon the fleshy part of the Midriff, especially its two processes, and on the Muscle *Psoas*. This Nerve being compressed by a Stone in the Kidney, there is caused a numbness in the Thigh of the same side. It sendeth also a twig along with the *Arteria praeparans* to the Stone, according to *Spigelius*. From whence it is partly, that too immoderate Venery causeth a weakness in the Loins. The *binder* is bestowed upon the *Musculus longissimus* of the Back, *Sacrolumbus*, &c.

The second cometh out between the first and second *vertebra* of the Loins, under the Muscle *Psoas*, which is the first of those that bend the Thigh. The *formore* branch is bestowed upon the second Muscle of the benders of the Thigh that fills up the cavity of *Os Ileum*, and on the *Musculus fascialis* and the Skin of the Thigh. The *binder* is bestowed upon the *Musculi glutai*, and the membranous Muscle which stretcheth out the Leg. That twig which from this pair joineth with the Intercoastal, goeth to the *Testis* of its own side (according to *Vesalius*, &c.)

The third marcheth out between the second and third *Vertebra*, under the *Psoas* also. The *formore* sendeth one twig to the Knee and Skin thereof,

thereof, and another which doth accompany the *Saphæna*. The *hinder* turneth back, and is bestowed upon the Muscles which rest upon the Loins.

The fourth. The fourth being the largest of the Muscles of the Loins, marching under the *Psoas* and *Os pubis*, doth accompany the Vein and Artery which pass to the Leg.

The fifth. The fifth cometh out between the fourth and fifth *Vertebra*. Its *fore* branch passeth through the hole that is between the bones of the *Coxendix*, *Pubes* and *Ileum*, and is bestowed upon the *Obturatores musculi* of the Thigh, the Muscles of the *Penis*, and on the neck of the Bladder, and of the Womb. The *hinder* is bestowed upon the Muscles and Skin which are above the *Vertebra*.

CHAP. XVII.

Of the Nerves which come from the marrow of Os sacrum.

Six of Os sacrum. FROM the marrow of *Os sacrum* six pair of Sinews spring.

The first pair. The first issueth out between the last *vertebra* of the Loins, and the first of *Os sacrum*, in the same manner as those that spring out of the *vertebra* of the Loins, and like them is divided into two branches. The *fore* branch is a great part of it mixed with those other of the Loins that go towards the Legs, yet it sends one twig to the Muscles of the Belly, and the second which bendeth the

the Thigh. The *hinder* is bestowed upon the Skin of the Buttocks, and the greatest *Glutæi*.

The other five pair spring after a different ^{Of the other} manner from the foregoing. For before they ^{five pair.} come out of the *Os sacrum*, they are every of them double on each side; and so from each on either side there arise two Nerves, one of which is carried into the fore or inner, and the other into the hinder or outer side. The *three uppermost* *formore* Nerves go towards the Leg, as the greatest part of the first pair did: The *two lower* to the Muscles of the *Anus* and Bladder; in Men to the *Penis*; in Women to the neck of the Womb, and in both to the external Privity. All the *five hinder* Nerves are distributed to the Muscles of *Os Ilium* and *Sacrum*, towards the back part, which are *Longissimus*, *Sacrolumbus*, *Sacer*, and the *Glutæi*.

And thus we have done with all the thirty pair of Nerves that arise out of the Spinal marrow, having shewn which way they pass and to what parts they are distributed: which should be diligently noted and well remembred, that we may the better know to what place to apply remedies, when from any outward cause, as from a fall, bruise or the like, any part has lost either sense or motion or both. For the Medicine is to be applied always to the beginning or rise of that Nerve that passes to that part, and not to the place in which the symptom appears. And the same thing is to be observed in Palsies, when the use of some particular Limb is taken away from an inward cause.

CHAP. XVIII.

Of the Face and its parts.

IN the former Chapters we have discoursed of that part of the Head that is decked with Hair, of the Brain, &c. contained within it, of the *Medulla oblongata* arising out of it and prolonged into the *Medulla spinalis*, with the Nerves that spring out of the same both within the Skull and in the Spine of the Back; all which we have considered as appendages to the Brain, seeing both the marrow out of which they arise, springs out of it, and also all the Nerves have their Animal spirits from it. And now we come to speak of that part which is not altogether garnished with Hair. In Latin it is called *Facies*, the Face, and *Vultus*, the Countenance.

Now though all the parts of the Body sufficiently shew the wisdom of the Creator; yet both the beauty of the Face, and its admirable consent with the mind doth epitomise as it were the comeliness and dignity of all the other parts, and exhibits their affections as in a Glass. For from it are not only taken signs of health, diseases, and imminent death; but also most clear tokens of the very disposition, manners and affections of the mind. For as shame and frightenedness betray themselves in the *Cheeks*, so do anger, joy, sadness, hatred, and especially love, in the *Eyes*. So from the *Forehead* are known ones gravity and humility; from the *Eyebrows* (or *Supercilia*) pride; from the *Nose*, sagacity or blockishness; &c.

ness; &c. from the motion of the Face, wisdom or foolishness, honesty or wickedness, civility or incivility, good-will or hatred; from its colour, the temperament of the whole Body. Besides, the sex, the age, the stock, and one Man from another may be distinguished by the Face.

The parts of the Face are either containing, or contained. The parts of the Face.

The containing are proper or common.

The common are the *Cuticula*, Skin and Fat. The *Membrana carnea* from the Eyes to the Chin is so thin that some have affirmed there is none: but in the Brows it is thicker, and cleaves very close to the Skin. Of these common parts we have discoursed Book 1. Chap. 3.

The proper are the Muscles, Bones and Cartilages, which shall each be described in their proper places.

The parts contained are the organs of the four Senses, viz. the Eyes, Ears, Mouth and Nose.

The Face is divided into its upper and lower part. The upper is from the Hair to the Eyebrows, and is called *Frons* the Forehead. This while the Body is entire belongs to the Face, but in a Skeleton to the Skull. The lower is extended from the Eyebrows to the Chin, and includes all the parts betwixt them.

A 2 2 CHAP.

CHAP. XIX.

Of the Eye in general, and its outward or containing parts.

THE Eyes (in Latin *Oculi*, from *occludo* to shut, or *occulto* to hide, because they lie hid under the Eyelids) are the organs of sight, consisting of many similar parts; and are as the two Luminaries of the Microcosm, to afford us light; or like two Watchmen placed in the upper part of the Body as in a Watch-tower, to give notice of any approaching danger. To lose them is the greatest misery can befall a Man: for 'tis the same as to be thrown into a Dungeon, when these windows of the Body are shut up.

Their number.

They are in number two, partly to make the sight stronger, and partly that one being hurt, the other might perform the office in some measure, though more imperfectly.

Figure.

The Eye alone, divested of its Muscles, is of a round or spherical shape, both that it might move the better, and also that it might more conveniently receive the visible rays.

Colour.

The colour of the Eyes in *Men* is sometimes grey, sometimes brownish, sometimes black: which variety is most conspicuous about the *Pupilla* in the *Iris*, and proceeds from the colour of the *Uvea*. *Brutes* of the same species have not that diversity of colours.

Bigness.

Some have much larger Eyes than others; but those which are largest and stand much out, have not so acute and piercing a sight as those that are less and stand further in.

They

They are each placed in a large Cavity, called *Orbita* (or the Socket) on each side the Nose, which is hollowed out of the bones of the Skull. And these orbits are invested on their inside with the *Pericranium*, to which the fat and origins of the Muscles cleave firmly. These may be reckoned the first containing parts of the Eye; as may also in the second place

The *Palpebra* or Eyelids, which serve as Cur-
tains to the Eyes, by which dust and troublesome
smokes and vapours, too much light and the in-
juries of the air are kept out, and the outward
membrane of the Eye called *Cornea* is moisten'd,
wip'd and clean'd. They consist outwardly of a
very thin Skin which has no fat under it; inward-
ly they are lined with the *Pericranium*, that is
here most thin and smooth. Betwixt these parts
comes the *Membrana carnosæ*, which is also very
thin. Each Eye has two. In Man the lower is
less, and is but very obscurely moved in compari-
son with the upper: but in Birds the lower is the
larger, and in most seems only to be moved, the
upper remaining unmoveable. As for their
Muscles to which they owe their motion, those
may be seen in the fifth Book. At their edges
they have little soft Cartilages, (called *Cilia* in
Latin) to strengthen them, and that they may
meet the more exactly. Upon these Cartilages
there grow Hairs, which having grown to a cer-
tain length, will naturally grow no longer, so
that they never need to be cut. Those on the
upper Eyelid turn something upwards, and those
on the lower downwards. Above the upper Eye-
lid grow also a set of Hairs, betwixt it and the
Forehead, out of the *Supercilia* or Eyebrows;

The Eye-
lids.

these lie pretty flat bending from within outwards, and hinder sweat, dust or other things from falling into the Eyes.

Canthi.

The Eyelids have two corners called *Canthi*. The *outer* of these is less, and in its upper part it has a Gland placed (usually called *Innominata*, or nameless, but might be named *Lachrymalis*, as affording the most of that *Lympha* that makes the Tears.) This Gland is conglomerate, being made up of many lesser, and has small twigs of Arteries that creep to it and deposite *Serum* or *Lympha* in it to supply matter for Tears upon occasion. But the ordinary use of this *Lympha* is to moisten the inner side of the Eyelids and the superficies of the Eyes, that they may move more glibly. *Diemerbroeck* having reckoned eight opinions concerning the cause, origine and matter of tears rejects them all, and this we have mention'd with the rest: and thinks that their matter is the more serous and thin particles of the pituitous humour gathered in the Brain, and flowing to the Eyes, upon its contraction, through the *Foramen lachrymale*. Which the learned Reader may see defended in his *Anat. lib. 3. cap. 15*. There is another Gland in the inner *canthus* or corner, which helps the former in its office. *Dr. Briggs* says, there are two or three lymphatick vessels, that receive *Lympha* from it, and end in the inner part of the Eyelid; and that eight arise out of the former Gland and end in the *Tunica adnata*, where they continually deposite something of *Lympha*, to keep the Eye moist. Nerves come to them from the fifth pair, which communicating with the Intercoastal, are much irritated in the passions of sudden joy or of sadness,

and

and so twitch and compress these Glands that the *Lympha* is squeezed or milked as it were out of them, as Dr. *Willis* ingeniously supposes.

As for the Muscles of the Eye, they shall be described in the fifth Book.

CHAP. XX.

Of the Tunicles of the Eye.

HAVING done with the outward or containing parts of the Eye, we come now to the Eye it self, and first of its Tunicles.

The outmost Tunicle of the Eye is *common*, and is called *Adnata*. It springs from the *Pericranium* and is spread over all the White of the Eye above the *Sclerotica*, reaching as far as the *Iris*. By this the Eye is kept firmly within its orbit, from whence it is also called *conjunctiva*. It is of very exquisite sense, and has many capillary Veins and Arteries creeping through it, which are most conspicuous in an Ophthalmy or inflammation of the Eyes. Under this Tunicle are the Tendons of the Muscles extended and expanded to the circumference of the *Iris*, which encrease its whiteness; and some take them for a second Tunicle, calling it *Innominate*.

The tunicles of the Eye, one common;

The *proper* Tunicles of the Eye are three, according to the threefold substance of the optic Nerve. For this Nerve (as all the other) consists of two Tunicles springing from the *Dura* and *Pia mater*, and an inner marrowy substance.

Three proper. 1. Sclerotica.

From the *Dura mater* springeth the outmost coat of the Nerve, and from this the Tunicle that is spread next under the *Adnata*, called *Sclerotica* from its hardness; but in its fore-part where it covereth the *Iris* and *Pupilla*, it is named *Cornea*, from its transparency; though sometimes this latter name includes the whole Tunicle, as well behind as before.

2. Choroides.

That which lieth next under the *Cornea* is much thinner than it, and is called *Choroides*, from its resembling the Membrane *Chorion* wherein the *Fetus* is included in the Womb. Its fore-part is otherwise called *Uvea*, because it is somewhat of the colour of a Grape. This springs from the *Pia mater*, and is spread from the bottom or centre of the Eye, behind all over the Eye to the *Pupilla*; to whose circumference when it is come, it becomes double, making with one part the *Iris*, with the other the *Ligamentum ciliare*. On the inside it is of a dusky colour, (in Man) but blacker on the outside. But where it makes the *Iris*, it is of divers colours resembling the Rainbow, from whence it borrows its name: yet in some it is more blue, in others black, in others grey. This Tunicle is perforated before as wide as the *Pupilla* (or sight of the Eye) to permit the rayes of visible species to pass in to the crystalline humour. Next unto which crystalline humour lies the *Ligamentum ciliare*, the second part of the duplicated *Uvea*. This consists of slender Filaments or Fibres, (like the Hairs of the Eyelids) running like so many black lines from the circumference of the *Uvea* to the sides of the crystalline humour, which they encompass and widen or constrict as there is occasion, by contracting

tracting or opening the *Foramen* of the *Uvea*.

The third Tunicle is made of the medullar substance of the optick Nerve, and is called *Retina* or *Retiformis* (Net-like :) This seemeth to be the principal organ of sight. For as Dr. Briggs well argues, neither the crySTALLINE humour, through which the rayes pass much refracted ; nor the Tunicle *Choroides*, are at all fit for this use. For this latter part (as rising from the *Pia mater*) cannot communicate the impressions of the rayes to the medullar part of the Brain, which it does not at all touch. Whereas the medullary Fibres of the *Retina* have communication therewith, and therefore can well perform that office. The Fibres of this Tunicle are extended from the bottom or inner centre of the Eye, where the optick Nerve enters it, as far as the *Ligamentum ciliare*, (to which it affords Animal spirits for the continuance of its motion.) If one take this *Tunica Retina* and put it into warm water, shaking it a little, to wash off the mucous substance that cleaves to it, and then hold it up to the light, these Filaments will appear very numerous like the threads of the finest Lawn.

3. Retiformis.

CHAP. XXI.

Of the Humours and Vessels of the Eye.

NEXT to the Tunicles of the Eyes are the Humours contained in them to be considered. And these are in number three, viz. *Aqueus*, *Crystal-*

The
mours of
the Eye
three.

CrySTALLINUS, and *VITREUS*. The second weighs as much again as the first, and yet not so much as the third by a sixth part. The *CrySTALLINE* is the most dense of consistence by much; and the glassy more dense than the watry.

1. *AQUEUS*. The *AQUEOUS* humour is outermost, being pellucid and of no colour (as neither are the other two.) It fills up that space that is betwixt the *CORNEA* and the *CrySTALLINE* humour before. If any thickish particles swim in it, then Gnats, Flies, Spiders webs and the like will seem to be flying before the Eyes. But if those particles grow still thicker, and close together so as to make a film, and this be spread before the hole of the *PUPILLA*, then is the sight quite taken away, which disease is called a *CATARACT*.

2. *CRYSTALLINUS*. The *CrySTALLINE* humour (so called from its being as clearly transparent as Crystal) is placed betwixt the aqueous and the vitreous, but not exactly in the middle or centre of the Eye, but rather towards its fore-part. It is inclosed in the bosom as it were of the vitreous humour, and is flattish on the fore-side, but rounder behind. It is more bright and solid than either of the other two. It has been the common opinion that it is inclosed in its proper Membrane, which is called either *CrySTALLINA* from its transparency, or *ARANEA* from its most fine contexture. But Dr. Briggs, a very accurate Anatomizer of the Eye, denies any such Tunicle, affirming that it is merely adventitious when the humour is exposed for some while to the Air, or is gently boiled. As to the collection or reception of the rayes of things visible, this humour is the primary instrument of sight: though as was said before, the *Tunica retina* is

is the principal as to perception, because through it the rayes are communicated to the common sensory.

The third and last humour of the Eye is the *Vitreous*, so called because it is like to molten glass. This is thicker than the Aqueous, but thinner than the Crystalline; and much exceeds them both in quantity, for it fills up all the inner or hinder hemisphere of the globe of the Eye, and a pretty deal (toward the superficies) of the formore. It is round behind, but hollowed in the middle forwards, to receive the Crystalline into its bosom. This humour is also said to be separated from the other two by a proper Tunicle, called *Vitrea*, which the aforesaid ingenious Author likewise denies.

See the situation of these Humours represented in Fig. 2. of the Table inserted p. 341.

The Eyes have *Arteries* from the *Carotides*, *The vessels* which bestow twigs on their Muscles, and on their *Tunics*. And these are accompanied with *Veins* springing from the branches of the Jugulars. As for their *Nerves*, they either assist the sense of seeing, and are called the optick Nerves, which we have reckoned for the second pair and described before Chap. 10. or serve for the moving of them, being inserted into their Muscles, and to this purpose serve the third and fourth pair, and some twigs of the fifth. As to their *Lympheducts*, we have spoken of them above Chap. 19. when we discoursed of the Glands placed at each *canthus* or corner of the Eye-lids.

CHAP.

CHAP. XXII.

Of the Auricula.

AS the *Eyes* are placed in the upper part of the Body like two Watchmen to descry approaching danger ; so are the *Ears* there seated also, that they might give information of what the *Eyes* cannot discover either in the night for want of light, or through some thick and opaque Body which the sight cannot penetrate. And as the *Eyes* contemplate the wonderfull works of God, whereby the mind may conceive of his Infinity ; so the *Ears* are the Inlets or Receivers of verbal instruction in all wisdom and science. For they are the organs of hearing, and are in number two, that the one failing, yet we might hear with the other. They are placed in the Head, because sounds ascend.

The parts of the Ear are either *outward* or *inward*. The *outward* is called *Auricula*, which is only an adjuvant instrument of hearing, being spread like a Van to gather and receive the sounds.

*The names
of its parts.*

Its upper part is called *Ala* or *Pinna* the Wing ; and its lower and soft Lobe, usually *Infima auricula*. It has several protuberances or eminences, and cavities. Its outer *protuberance* that makes its circumference, from its winding is called *Helix* ; and that which is opposite to it, *Anthelix* ; but that next the Temple, because in some it is hairy, is called *Hircus* or *Tragus* ; and that which is opposite to it, to which the soft lobe of the Ear is annexed, *Antitragus*, which likewise
in

in some is hairy. Its *Cavities* are three. The inmost, because of the yellow Ear-wax (as we call it) that is gathered in it, is named *Alvearium*; as also *Meatus auditorius*: the next to this outwards which is bigger, from its tortuosity or winding is called *Concha*. The third is that betwixt the *Felix* and *Anthelix*, which has had no name imposed on it.

The constituent parts of the *Auricula* are either common or proper. The common are *Cuticula*, *Cutis*, *Membrana nervea*, and fat in the Lobe. The proper are the Muscles, Veins, Arteries, Nerves and the Cartilage. As concerning the *Muscles*, they are set down in their proper treatise. The *Veins* come from the external Jugulars; the *Arteries* from the *Carotides*; the *Nerves* from the second pair of the Neck, being joined with the harder process of the seventh pair. As for the *Cartilage*, it is a substance that is fittest for this place. For if a Bone had been here, it had been troublesome, and might by many accidents have been broken off: if Flesh, it had been subject to contusion. It serves to keep this outer part of the Ear expanded and open, and is tied to *Os petrosum* by a strong Ligament which riseth from the *Pericranium*. Its constituent parts.

The *uses* of the outward Ear are these: First, *Uses.* it serveth for beauty. Secondly, to help the receiving of the sounds. For first, it gathereth them being dispersed in the Air. Secondly, it doth moderate their *Impetus*, so that they come gently to the *Tympanum*. Such as have it cut off upon any occasion, are very much prejudic'd in their hearing, which becomes confus'd with a certain murmur or swooning like the fall of waters.

Both

Both behind and below the Ears there are several Glands outwardly under the Skin, that are called *Parotides*. But there are two more notable than the rest, near one another; of which one is lesser, and is conglobate; but the other bigger, consisting as it were of many lesser, and is conglomerate. These serve to sustain the vessels that ascend this way, and are usually reckoned as Emunctories of the Brain. In the conglomerate Gland the *Saliva* is separated.

CHAP. XXIII.

Of the inward part of the Ear.

THE inward part of the Ear is that which we properly call *Auris*, and begins at the *Meatus auditorius*, or that inmost cavity in which the Ear-wax is collected. This cavity ascends something with a winding duct, partly that if any thing fall into it, it may more easily be got out again; and partly that the vehement *Impetus* of the sound may be a little infringed. The Wax that is gathered in it is an excrement of the Brain, and by it Insects are hindered from creeping in, entangling them as Bird-lime.

The Tym-
panum.

Before its inner end is spread the *Tympanum* or Drum, which is a nervous, round and pellucid Membrane, of most exquisite sense. Some will have it to spring from the *Pericranium*, others from the *Pia mater*, a third sort from the *Dura mater*, a fourth from the softer process of the Auditory nerve expanded. And lastly, some think

think that it has a proper substance, springing from no other Membrane, but made in the first conformation of the parts. It is very dry, that it might give the better sound. It is strong, that it should the better endure external harms. It hath a cord behind it for strength and stretching of it, even as the military Drum hath, which some take to be a Nerve, others a Ligament. It hath two Muscles to move it, which shall be described in the fifth Book.

When it is taken away, in the first cavity on the inside of it (which also by some is called *Tympanum*) there appear four small Bones. These have no marrow in them, nor are covered with any Membrane or *Periostrum*, yet at their extremities where they are joined, they are bound with a small Ligament that proceeds from the Cord or Ligament of the *Tympanum* above-mentioned. And they have this also peculiar to themselves, that they are as big in Infants as in grown persons.

Four little bones.

The first is called *Malleolus*, the little Hammer. It hath a round Head, which is articulated into the cavity of the Anvil by a loose Ligament. This Head is continued into a small Neck, which reaching beyond the middle of the *Tympanum*, adhereth to it. About the middle it hath two processes: The one of which, being shorter, has the Tendon of the internal Muscle inserted into it; and the other, being longer, the Tendon of the external, the *Tympanum* coming between.

1. Malleolus.

The second is called *Incus*, the Anvil, having one Head, and two Feet, being somewhat like one of the grinding or double Teeth that has two roots. The Head is somewhat thick, having in the

2. Incus.

the top of it a little smooth cavity, which receiveth the knob or head of the Hammer. The smallest and longest Foot is tied to the top of the Stirrop by a loose but firm Ligament; but the thickest, broadest and shortest resteth upon the *Os squamosum*.

3. *Stapes*. The third is *Stapes*, or the Stirrop. In figure it is triangular, in the middle hollow, to give way to the passing of the Air to the *Labyrinthus*. In the upper part of it is a very small and round knob, upon which the longest foot of the Anvil resteth. Its shape is much adapted to the *Fenestra ovalis* (which opens into the Labyrinth) about which it is tied round somewhat loosely, so that it may be driven to within its *Sinus*, but cannot without violence be pulled outwards.

4. *Os orbiculare*. The fourth Bone was found out by *Franc. Sylvius*, and from its round shape is called *Orbiculare*. It is tied by a slender Ligament to the side of the *Stapes*, where the *Stapes* is joined to the *Incus*.

From the lower side of this first inner cavity, wherein these Bones are contained, there is a round *Meatus* to the Palate of the Mouth near the root of the *Uvula*, and another that runs to the cavity of the Nostril, by which pituitous matter collected in it is discharged. And by the help of that which opens into the Mouth it is, that deafish people are assisted in hearing, for we commonly observe such to open their Mouth when they listen attentively.

In the middle also of this cavity there are two holes, the greater and higher of which is shut by the basis of the *Stapes* (when no sounds penetrate the Ear) and is of an oval figure, whence it is called *Fenestra ovalis*, and opens inwards or backwards

*Fenestra
ovalis,*

wards pretty wide into the Labyrinth. The other is less and lower, and is of a round shape, whence it is called *Rotunda*. And this is always open, having no covering, and is divided into two pipes divided by the *Os squamosum*, one of which tends to the *Cochlea*, the other to the Labyrinth.

This *Labyrinth* is the second inner cavity, being far less than the former, and was first so called by *Fallopins*, from the hollowed bony semicircles (cloathed with a thin membrane) returning circularly into the same cavity. The *Fenestra ovalis* opens into it out of the first cavity: and besides this hole it has five others, one of which opens into the end of the larger *Gyrus* or winding of the *Cochlea*: The other four are so small that they hardly admit an hair, through which the most slender Fibres of the auditory Nerve proceed to the inner membrane that encompasses this cavity.

The third and last inner Cavity is called *Cochlea*, because in its spiral winding it resembles a Snail's Shell. It is less than the Labyrinth, and has two, sometimes three or four such windings, which are cloathed inwardly with a most thin Membrane, into which, as into the Labyrinth, the slender Fibres of the auditory Nerve enter, through three or four very small holes.

These three inner Cavities are all formed within the inner *Processus petrosus* of the Temple-bone. And in them is contained a most pure and subtile Air, which some think to be included in them in the very first formation of the parts, and therefore call it *Aer Insitus* and *Congenitus*: Some suppose it to be Animal spirit, effused into them by the auditory Nerve.

This inner part of the Ear has Veins, Arteries and Nerves from the same origins as the outer : only the *harder* process of the auditory Nerve goes to the *outer*, and the *softer* to this *inner*, which coming by the hinder *Meatus* of the *Os petrosum* is inserted into and dispersed through the circles of the *Cochlea* and Labyrinth.

Hearing
what.

All the parts of the *Auricula* and *Auris* concur to the perfecting the *hearing*, which is a *Sense* whereby sound is perceived from the various trembling motion of the external Air, beating upon the *Tympanum*, and thereby moving the internal Air with the *Fibres* of the auditory Nerve, and communicated to the common *Sensory*. Now sound that is the object of it is nothing else but a quality arising from the Air or Water beat upon and broken by the sudden and vehement concussion of solid bodies. And the diversity or greatness of such sound is distinguished by the four Bones that stand on the inside the *Tympanum* : For as from the greater or less, gentle or harsh impulse of the external sonorous Air (fluctuating like Waves caused by a Stone thrown into the Water) the membrane of the *Tympanum* is accordingly driven or shak't against the *Malleus*, the *Malleus* against the *Incus*, and the *Incus* against the *Stapes* ; so, as the same *Stapes* and *Os orbiculare* open the *Fenestra ovalis* more or less, is there a freer or straiter passage granted to the internal Air into the Labyrinth and *Cochlea*, in whose tortuous and unequal windings it is variously infringed and modulated, from whence the *species* of sound that is made thereby, (according to the diversity of the external impellent) is sometimes more acute, sometimes more full, sometimes more harsh, sometimes more gentle,

gentle, sometimes bigger, sometimes less: the *idea* of which *species* is carried to the common Sensory (and so represented to the mind) by the Auditory nerve that expands it self through the Membrane that invests the said Labyrinth and *Cochlea*.

CHAP. XXIV.

Of the Nose.

THE organs of *Seeing* and *Hearing* being described in the foregoing Chapters, we come now to the instrument of the third Sense, *viz. Smelling*, which is the *Nose*.

The parts of the *Nose* are either *external* or *internal*. The *external* parts are these, the Skin, Muscles, Veins, Arteries, Nerves, Bones and Cartilages. First, the *Skin* cleaveth so fast to the Muscles and Cartilages, that it cannot be severed without renting. Secondly, as for the *Muscles*, they are set down in the description of the Muscles Book 5. Thirdly, the *Veins* come from the external Jugulars, as the Arteries from the *Carotides*. Fourthly, the *Nerves* come from the third pair, on each side one. Fifthly, the *Bones* of the Nose are set down in Book 6. Chap. 6. Sixthly, the *Cartilages* are in number five; the two upper are broader, and adhere to the lower side of the Bones of the Nose where they are broader and rough, and being joined to one another pass from thence to the tip of the Nose, making up one

Its external parts.
1.
2.
3.
4.
5.
6.

half of the *Ala*; the two *under* make up the other half; the fifth divideth the Nostrils. These Cartilages are moved by the Muscles.

*Its inner
parts.*

The *inner* parts of the Nose are these: First the Membrane which covereth the inside of the Nose, which proceedeth from the *Dura mater*, and passeth through the holes of the *Os cribriforme*. This Membrane on its backside hath abundance of little *Papilla* or Glands; in which the *Serum* or Rheum is separated that runs out by the Nose. Secondly, the Musculous membrane, which draweth together the Nostrils. Thirdly, the hairs which disperse the air, and hinder the creeping in of Insects. Fourthly, the red fleshy spongy substance, with which the holes of the *Os spongiosum* are filled up; from which the *Polypus* springeth.

The length of a comely Nose is the third part of the length of the Face.

*The deno-
mination of
its parts.* The upper part of the Nose which is bony, is called *Dorsum nasi*, or the ridge. The lower lateral parts, where the Cartilages are, *Ala*, or *Pinna*. The tip of the Nose, *Globulus*, and *Orbiculum*. The fleshy part, that at the bottom of the *Septum* reaches from the tip of the Nose to the upper Lip, is called *Columna*. And the two holes that are caused by the partition, *Nares* the Nostrils. And these about their middle are each divided into two, one of which goes up to the *Os cribriforme*, to convey scents thither; the other descends down upon the Palate to the *Fauces*, by which Rheum falls down either of its own accord if it be very thin, or by snuffing the air up strongly in at ones Nose, if it be thick, which we may hawk and spit out at pleasure.

The

The Nose is an external adjuvant organ of *Insusfer*. Smelling, as the *Auricula* is of Hearing. For when smells exhale out of odoriferous bodies into the air, by taking our breath in at the Nose, the scents accompanying the air ascend up the Nostrils to the top of their Cavity, viz. to the *Os cribriforme*, through whose holes the olfactory Nerves (otherwise called *Processus mammillares*) issue out by their Fibres, and are the inward immediate and adequate organ of Smelling. Other inferiour uses the Nose has also; as first, sometimes to take in our breath by, that we may not keep our Mouth always open for that purpose. Secondly, to help the Speech, which is very much impaired by the loss of it. Thirdly, it serves for the separation and discharge of the superfluous humours in the Blood. And the like.

CHAP. XXV.

Of the Lips.

AS to the Cheeks, their substance being Muscular, this is no proper place for the description of their parts (but Book 5.) only we shall note that their upper part next under the Eyes, that jets out a little and is commonly highest of colour, is called *Malum* or *Pomum faciei*, in English commonly the Ball of the Cheek; and their lower part that is stretched out in blowing of a Trumpet or the like, is called *Bucca*. Therefore we shall pass on to the *Mouth*, wherein is

contained the Tongue the instrument of Tasting, &c. The use of it is fourfold; for it serveth for breathing, taking of food, speaking, and discharging of the excrements of the Brain, Lungs, &c.

The external parts of the Mouth, viz. the Lips.

The parts of the Mouth are either *external* or *internal*. The *external* are the *Lips*: these are framed of a carnos soft fungous substance, and of the Muscles, covered with a thin Skin. They are in number two, the upper and the lower. (Of their Muscles see Book 5.) The upper Lip has a little dimple in its middle which is called *Philtrum*; and its sides are named *μύσες*, whence the hair that grows thereon is called Mustaches. The inside of the Lips is covered with a Membrane common to the Mouth and Stomach; and from hence cometh the trembling of the lower Lip before vomiting.

The uses of the Lips.

The uses of the Lips are these: First, they help to retain the meat in the Mouth while it is chewing. Secondly, they serve for beautifying of the Face, if they be well fashioned. Thirdly, for the containing of the Spittle in the Mouth, that it should not run out at unseasonable times. Fourthly, to keep the Gums and Teeth from external injuries. Fifthly, for framing of the Speech.

CHAP. XXVII.

Of the inner parts of the Mouth.

THE inner parts of the Mouth are these :
The Gums, the Teeth, the Palate or Roof
of the Mouth, the Almonds, the *Uvula*, the
Tongue, and *Ductus salivales*.

The *Gums* (*Gingivæ*) are two, made up of a 1. *Gums*.
hard fleshy substance, destitute of motion, set
like a Rampire about the Teeth for the keeping
of them in their Sockets. As for the *Teeth*, look 2. *Teeth*.
for them in Book 6. Chap. 8. The *Roof of the* 3. *Palate*.
Mouth is its upper part, something concave like
a Vault, formed in the *Osses sphenoides*, and serves
partly for perfecting of the voice by repercussing
the air, and partly assists the sense of Tasting.
It consists of Bones (of which, Book 6. Chap. 6.)
of a peculiar glandulous Flesh and a thick Tunicle,
with little holes for the *Saliva* that is separated in
the Glands to destil through into the Mouth.
Of the *Tonsilla* or Almonds we have spoken before 4. *Almonds*
in Book 2. Chap. ult. The *Uvula* is a red, spon- 5. *Uvula*.
gie and longish Caruncle, that being somewhat
broad at its basis hangs down from the middle of
the Palate (where the Nostrils open into the
Mouth) with a small but bluntish end. It is co-
vered with a very lax and soft Skin, and is often
swelled with defluxions of Rheum, hanging down
flabby, which is called the falling of the *Uvula*,
and by ignorant people, the falling of the Roof
of the Mouth. The *Tongue* (*Lingua*, à *Lin-* 6. *Tongue*.
gendo, from licking) is the instrument of Taste

and Speech. It is long and broad, thicker at the root than towards the tip. It is cloathed with two *Membranes*; The *outer* covers only the upper part of the Tongue, and is very porous, being pretty smooth in Men, but in Brutes it is rough with abundance of copped bodies arising out of it, (and bending towards its root) like the Teeth of Wool-cards, of something a cartilaginous substance. This Membrane has a line that runs lengthways of it in its middle; dividing the Tongue into two parts. The *inner* covers the whole Tongue, the lower side as well as the upper. This is thin and soft, and has many *Papilla* protuberating out of it, which are inserted into the pores of the outer. As to the substance of the Tongue there is great diversity of opinions. Some think it to be a Gland; others, that it has a peculiar substance; *Spigelius*, that it is truly a Muscle; and so does Dr. *Wharton* call it *verus Musculus*, though towards its root (he saith) it hath something of a glandulous substance. *Malpighius* (*exercit. Epistol. de lingua, p. 9.*) says it is rather musculous than glandulous; and describes its substance thus. "Immediately under the afore-
 "said Membranes there lie streight fleshy Fibres,
 "whereby the Tongue is drawn inwards and short-
 "ned. But the centre of the Tongue consists of
 "a manifold kind of Fibres, long, transverse and
 "oblique, which riding one upon another are
 "interwoven like a Mat.] But though this be its substance, yet it cannot properly be called a Muscle, both because no Muscle serves to move it self, but some other part; and also because one Muscle is not moved by another, as the Tongue is by several pair, described Book 5. It is connected

ned to the *Os hyoides*, *Larynx*, and *Fauces*, and by a membranous Ligament to the parts under it. The extremity of which Ligament is called *Frænum*, which being too short, or extended to the top of the Tongue, hindreth sucking in Children, when they are said to be Tongue-tyed.

Its *Veins* proceed from the external Jugulars, *Its vessels*, and are very apparent under the Tongue, where they are called *Ranulares*. The *Arteries* come from the *Carotides*. *Nerves* it hath from the fifth and eighth pair.

The *actions* and *uses* of the Tongue are these: *Its actions and uses*. First, it is the instrument of Tasting; especially the *Papilla* in its inner Membrane, which have the extremities of the Nerves inserted into them. Secondly, it formeth or modulateth the Speech. Thirdly, it helpeth the chewing of meat, by tossing of it to and fro, and turns it down to the Stomach.

Besides the several Glands in the Membrane that invests the inside of the Mouth, there is a very notable one that lies deep under the Tongue, from whence two Pipes, called *Ductus salivales*, ascend obliquely to the sides of the *Frænum* of the Tongue, where each is inserted into another small Gland, through which they pour that *Saliva* into the Mouth which they first received from the foresaid notable Gland. These were not unknown to the Ancients, but are more particularly described by Dr. *Wharton*. Besides these, *Steno* about twenty years ago found out two more, which arising out of the greatest (conglomerate) Gland at the root of the Ear run on the outside of the Jaw-bone to the center of the *Musculus buccinator*;

Ductus salivales.

cinator; and there end into the cavity of the Mouth, into which they discharge the *Saliva* they had imbibed out of the Glands. Now this *Saliva* or Spittle is first separated from the Arteries by the Glands, and is not a meer excrement, but serves for the furthering of the fermentation of Meats in the Stomach, if it be not the main ferment of it. That it has a fermentative quality *Diemerbroeck* proves by this experiment, That if a piece of white Bread be chewed and moisten'd with much Spittle, and then be mixed with Wheat-paste kneaded with warm Water, it will make it ferment.

The end of the Third Book.

The Fourth Book.

CONTAINING
A Description of the VEINS,
ARTERIES and NERVES
OF THE
L I M B S.

CHAP. I.

Of the Veins of the Arms.

IN Book 2. Chap. 9. treating of the Ascending trunk of the *Vena cava* we shewed that when it arrived at the top of the *Thorax* it was divided into two branches called *Rami subclavii*; which running obliquely under the *Clavicula*, as soon as they were past them and come to the Arm-pit, were called *Axillares*; and each of these parteth it self into two Veins, the *Cephalica*,
and

and *Basilica*. But before their division they send forth two small Veins, viz. *Scapularis interna* and *externa*; whereof the first passeth to the Muscles that lie in the cavity or inside of the *Scapula*, the latter to those on the outside.

The *Cephalica* passeth through the upper and outward part of the Arm, to the bending of the Elbow, where it is divided into two branches; of the which one, joining with the *Basilica*, makes the *Mediana*, which is very frequently opened when one is let blood in the Arm: The other, marching according to the length of the *Radius*, reacheth to the Hand, through which it is spread; but chiefly in that part which is between the Ring-finger and the little Finger, where it is called *Salvatella*.

The *Basilica* passeth through the inner and lower part of the Arm, accompanied with the Artery and Nerves.

About its beginning there spring out of it the *Thoracica superior* and *inferior*, (though sometimes these arise from the Axillar before its division) of which the former runs to the inside of the pectoral Muscle, &c. the latter to the *Musculus latissimus* of the Back, and all over the side of the *Thorax*, where 'tis said to inosculate with the twigs of *Vena sine pari*.

Basilica about the bending of the Elbow is divided into that which is called *Subcutanea*, and that which is called *Profunda*.

Profunda, the deeper, is annexed to the Artery about the bending of the Elbow, not under. Then passing between the *Ulna* and *Radius* it is carried to the Hand by the outer part of the *Ulna*.

The

The *Subcutanea*, or the shallowest branch, near to the bending of the Arm being turned up to the outer part of the *Ulna*, is carried along it to the Hand.

The *Mediana* is also double, *Profunda* and *Subcutanea*; both which run by many twigs through the Muscles of the Cubit to the Hand and Fingers.

Note, that since the circulation of the Blood has been generally believed, it is held indifferent which of these three Veins (the *Cephalica*, *Basilica* or *Mediana*) are open'd in blood-letting; for they all receive their Blood from one common Artery, viz. the Axillar, which returns by them all indifferently towards the Heart: only it is best to open that which is fairest.

CHAP. II.

Of the Arteries of the Arm.

ASoon as the *subclavian* branches of the ascending trunk of the *Aorta* are past out of the *Thorax*, they are called *Axillar*, (like the Veins) as we shewed in Book 2. Chap. 11.

This Artery before it arrive at the Arm sendeth out of its upper part the *Humeraria*, which is bestowed on the Muscles of the Shoulder: and out of its lower, *Thoracica superior*, *inferior*, and *Scapularis*, which run to the same parts with the Veins of the like denomination in the foregoing Chapter. Then having communicated small twigs to the Glands in the Arm-pit, it accompanieth
the

the *Basilica* along the Arm, (for there is no cephalick Artery.) When it is come to the bending of the Elbow, it is parted into two branches, which pass almost wholly to the inner side of the hand; for the backside hath no Artery but from a small twig that runs betwixt it and the bone of the Thumb.

The one of these resting upon the *Radius*, is that which beats about the Wrist, and is commonly felt by Physicians.

The other marcheth by the *Ulna*, and with the former is spread through the Hand.

CHAP. III.

Of the Nerves of the Arm.

THE Nerves that spring from betwixt the three lowest *vertebra* of the Neck, and the first three of the Back do every one send a branch towards the Arm; all which for their greater strength uniting with one another, and again separating are carried under the *Clavicula* to the Armpit, where they are interwoven together like a Net; but they pass out of it again separate one from another. The first of them that springs from the fifth pair goes to the Muscle *Deltoides*, to the second Muscle of *Os hyoides*, and to the Skin of the Arm. All the other five are bestowed wholly on the Muscles and Skin of the Arm and Hand.

CHAP.

CHAP. IV.

Of the Veins of the Thigh, Leg and Foot.

THE Iliacal branches of the *Vena cava* after they are descended as far as the Thigh (where we left them B. 1. Ch. 13.) are called *Crurales*, which being past the Groins are each divided into six more notable Veins, viz. *Saphæna*, *Ischias major* and *minor*, *Muscula*, *Poplitea* and *Suralis*. The first called *Saphæna* descends down on the inside of the Thigh and Leg betwixt the Skin and *Membrana carnosæ*, and appears pretty large on the inside of the Ankle, where it is frequently opened in Diseases of the Womb, and may with great safety, having neither Artery nor Nerve accompanying of it. The *Ischias major* is that which runs down on the outside of the Ankle; but the *minor* goes no further than the Muscles of the Hip. The other three are spent on the Muscles, Skin, &c. of the Thigh, Leg and Foot.

CHAP. V.

Of the Arteries of the Thigh, Leg and Foot.

IN B. 2. Ch. 11. describing the descending branches of the *Aorta*, we traced them to the Thighs, where the *Rami iliaci* begin to be called *Crurales*, as was said of the Veins. The Crural artery is less than the Vein, and before it arrive at the Ham sendeth forth three branches, viz. *Muscula cruralis exterior*, *interior*, and *Poplitea*. The first enters the fore Muscles,

Muscles, the second the inner Muscles of the Thigh; and the third runs down the hinder Muscles as low as the Ham, whence it has its name. When the trunk of the Crural artery is past the Ham, it sends out three more called *Tibiaa exterior*, *posterior elatior* and *posterior humilior*, which are bestowed on the Muscles, Skin, &c. of the Leg and Foot; and what remains of it descends to the Foot, upon which it is spent.

CHAP. VI.

Of the Nerves of the Thigh, Leg and Foot.

THE three lower pair of Nerves of the *vertebrae* of the Loins, and the four uppermost of *Os sacrum* constitute the Crural nerves. For all these very near their rise joining together, and proceeding united for a while, make four Nerves. The *first* and *third* enter the Muscles that lie upon the Thigh-bone whether for *its* motion, or of the Leg. The *second* accompanies the Crural Vein and Artery down by the Groins and the inside of the Thigh, on whose formore Muscles it is most of it spent, but sends one notable branch down the Leg, as far as to the great Toe. The *fourth* is the thickest, hardest and strongest of all the Nerves in the Body. This distributeth twigs to the Skin of the Buttocks and Thigh, to the Muscles of the Thigh and Leg, and being descended to the Ham is divided into the outer and inner branches, which bestow twigs on all the Muscles and Skin of the Leg and Foot, to which there comes no other Nerve, but the foresaid branch of the *second*.

The end of the Fourth Book.

The Fifth Book.

CONTAINING
A Treatise of all the
M U S C L E S
Of the B O D Y.

CHAP. I.

The description of a Muscle.

A Muscle in Greek is called $\mu\upsilon\varsigma$ a mouse, *The de-*
of which *Musculus* in Latin is but a dimi-*scription of*
nutive ; as if it resembled a fley'd mouse : *a Muscle.*
or else from $\mu\upsilon\omega$ to contract. *It is a dissimilar or*
organical part, (framed of its proper membrane,
a fibrous flesh, a Tendon, Veins, Arteries, and
Nerves) *appointed by nature to be the instrument of*
free motion.

The parts then are either *common* or *proper*. The *parts*
common are three : The Vein, the Artery, and the *constitu-*
Nerve.
C c

Nerve. The *proper* as many, *viz.* the fibrous flesh, the Membrane, and the Tendon.

Arteries.
Veins.
Nerves.

The *Arteries* bestow on the Muscles (as on all the other parts of the Body) Vital heat and nourishment; the *Veins* carry back from them what blood is not assimilated to them; and the *Nerves* bring Animal spirit whereby their action is performed. And these Nerves spring either from the *medulla oblongata* within the brain; or from the *spinalis*, so called after it is descended out of the skull into the spine. The Nerve is implanted either into one end, or about the middle of the Muscle; but at what part soever it is inserted, that is the head or beginning of the Muscle. As soon as it hath entred into the substance of the Muscle, it is dispersed into a number of *twigs*, which end, in it, and are continued or elonged into *Fibres*.

Fibrous
flesh.

A *fibre* is thus defined by Dr. *Glisson* in cap. 4. de Ventric. *A body in figure like a thread, slender, tenacious, tensile, and irritable, made of spermatick matter, for the sake of some motion and strength.* Which he thus explains: "*In figure like a thread*]" i. e. oblong and round; *slender*] like a spiders web; *tenacious*] whose parts firmly cohere and are not easily broken; *tensile*] viz. that may be extended as to longitude, its latitude being less'n'd, and in like manner that may be thick'n'd as to latitude, its longitude being short'n'd; *irritable*] i. e. which by irritation may be excited to contract it self, and the irritation ceasing, to be remitted of its own accord; *made of spermatick matter*] namely if it be a bare Fibre; but if it be stuf with a *parenchyma*, perhaps it is not always made of only spermatick matter; (for the stuf Fibres may be divided into sanguineous

“neous and spermatick; of the former kind are
 “those of the Muscles; of the latter, those of the
 “stomach and guts:) for the sake of motion and
 “strength] for in that it is tenacious it adds strength
 “to the part, and that which is apt to be exten-
 “ded and contracted is destin’d for some mo-
 “tion.] These Fibres being stuf in their interstices
 with a sanguineous *parenchyma*, are that which
 we properly call *flesh* (without fat.) For (saith
 Dr. Croone) all the flesh of a Muscle (which makes
 the greatest part of it, and of which the bulk of
 the whole body chiefly consists) seems to be no-
 thing else but that portion of the blood that flows
 through the intervals of the Fibres, which thicken-
 ing by their coldness is staid amongst them, and
 makes the musculous flesh. The Fibres are com-
 monly streight; wherefore the Muscles of the belly
 (called oblique and transverse) have not their
 denomination from their Fibres, for they are all
 streight; but from their own position and situa-
 tion: so the Muscle called *Masseter*, is accounted
 double, because it hath two sorts or ranks of Fi-
 bres, one lying upon another.

Every Muscle hath a proper *membrane* that in-
 vests it, and distinguishes it from others. It is con-
 tinued unto the Tendon in such Muscles as have
 one. *Membrane.*

The last proper part of the Muscle is the *Tendon*. *Tendon.*
 It is a similar body, of a *sinewy-like* substance, (yet
 it hath a peculiar substance differing from a si-
 new) white with a kind of brightness, dense, hard,
 and smooth, extended according to the length of
 the Muscle. Its beginning may be reckoned to be
 at the head of the Muscle, whence passing through
 the belly of it, it endeth in the tail. *Its begin-
ning.*

Which mus-
cles have
tendons.

All Muscles which are appointed for the moving of bones, have Tendons which are inserted into them; but commonly those which move other parts, as the Tongue, Lips, &c. as also the Sphincter of the Bladder, and *anus*, have none, or however such as are not easily discoverable; for indeed some affirm (as Dr. Croone) that every Muscle has its Tendon.

Of what a
tendon is
framed.

It is not framed of the Nerve and Ligament mingled together, as many have imagined: First, because a Nerve being lax and soft, will not admit commixtion with the Ligaments being hard. Secondly, because the Nerve is not carried in the form of a Nerve to the Tendon, but is either continued to or makes the Fibres of the Muscle. Thirdly, Ligaments are insensible, but Tendons are of exquisite sense; as appeareth by the great pain which ensueth if they be pricked. But either it is framed by nature out of the first matter of the *Embryo*, as other parts called *Spermatick* are, and so is an independent part: or else it is a coalition of the Fibres of the Muscle, being emptied or freed of their *parenchyma*.

The figure
of tendons.

The Tendons are sometimes round, as in the *musculus biceps*; sometimes broad, as in the oblique and transverse Muscles of the Belly.

The parts
from the
position.

These are the parts constitutive of a Muscle. It hath besides these, parts derived from the Position; and those are three: The Head, the Belly, and the Tail. The Head is the beginning, or that part unto which the Muscle is contracted: the Belly is the thickest part and the most fleshy: the Tail is the ending of it, and is inserted into the part which is moved. It is called in Greek *σύνδεσμος*, and commonly *Tendo*.

The

The use of a Muscle was set down in the last part of the description, in that it was said to be the instrument of *free motion*; which word we rather make use of than of *voluntary*, because beasts have Muscles and motion, unto whom *will* properly so called is denied, because it presupposeth reason.

The use of a muscle.

CHAP. II.

Of the differences and actions of the Muscles.

THE differences of Muscles are taken from sundry things: First, from their *substance*: so some are fleshy, as sundry of the Tongue and larynx: some are membranous, as the *constrictores* or internal *adductors* of the nose: and some are partly fleshy, and partly nervous, as the temporal.

The differences of muscles.

Secondly, from the *quantity*. Some are long, as the straight Muscle of the *abdomen*, the longest of the back, &c. others short, as the pyramidal at the bottom of the *abdomen*: some broad, others narrow: some thick, others thin and slender, &c.

Thirdly, from the *situation*: from hence some are called *external*, some *internal*; some *oblique*, some *straight*, some *transverse*.

Fourthly, from the *figure*: as *deltoides*, because it resembleth the Greek letter Δ *delta*. Some round, others square, &c.

Fifthly, from their *beginning* : so some proceed from *bones*, one or more ; some from *cartilages* or *gristles*, as those of the *larynx*.

Sixthly, from the *variety of parts* ; so some are called *bicipites* and *tricipites*, having two and three heads ; others *birventres*, having two bellies.

Seventhly, from their *composition* ; so some are single, some double ; because some have more heads, some more tails than one. The unity of the Belly and Membrane which enwrappeth the Muscle, causeth the unity of it ; and the plurality of the Membranes and Bellies, the plurality of Muscles.

*The causes
of the unity
and plurality
of muscles.*

Eighthly, from their *action*. Four differences of Muscles are taken from hence : for *first*, some are hence called *fraterni* or *congeneres*, brotherly ; some *antagonistæ*, adversaries. *Secondly*, some onely move themselves, as the *sphincters* ; some other parts, as the rest. *Thirdly*, some have one onely action, as the greatest part of the Muscles ; some have divers actions, as the *masseter* and *trapezius*. The *fourth* difference is taken from the variety of the action ; so some are called *flexores*, others *extensores* ; some *elevatores*, others *depressores* ; some *adductores*, others *abductores*. Others *suspensores*, *rotatores*, &c.

*The proper
action of a
muscle.*

As for the proper action of a Muscle, it is nothing else but the contraction of it towards its beginning.

*The cause
of the di-
versity of
the action.*

The diversity of the action proceedeth from the diversity of the situation of the Muscles : so a streight Muscle hath a streight motion ; a transverse, a transverse motion ; an oblique, an oblique motion ; and that which compasseth a part hath an orbicular motion as the *sphincters*. So all

internal

internal Muscles serve for bending ; all *external* for stretching out.

Now of the motion of the Muscles there are four differences ; first, the contraction : secondly, the perseverance of the contraction : thirdly, the relaxation of the contraction ; and fourthly, the perseverance of the relaxation. This perseverance is called *motus tonicus*, whereas the member is still kept in the same posture.

The difference of the motion of muscles.

Motus tonicus.

The efficient cause then of the action is the soul, moved by its appetite. It useth three Instruments, the Brain, the Nerve, the Muscle : the Brain receiveth the charge, the Nerve carrieth it to the Muscle with the animal spirits, and the Muscle doth perform the action. So that a Muscle from its action may thus be described : A Muscle is an organical part of the body, appointed for the free contraction of it self towards the beginning, for the moving of the part into which it is inserted.

The efficient cause of the motion.

A description of a muscle from its action.

CHAP. III.

Of the Muscles of the Eye-lids.

THE Lids of each Eye have three Muscles : the first is called *rectus* or *aperiens*, to lift it up. This is placed in the upper region of the orbit of the Eye, and springeth from the same origine with the *elevator* of the Eye, (above it) namely at the hole through which the optick Nerve passes into the orbit, and holds the same course with it, being of the same figure and substance,

Rectus.

viz. fleshy, till at last parting from it with a pretty broad but thin Tendon, it is inserted into the cartilage of the upper Eyelid, which it serves to lift up, and so to open the Eye.

Semicir-
cularis.

The two others are called *Claudentes*, or shutters of the Eyelids, as also *semicircularis* (others call them *circularis* taking them for one.) They are placed between the *membrana carnosæ* and that Membrane that is extended from the *pericranium*. Each Eyelid has one, the upper a larger, the lower a less. That which draweth down or shuttereth the upper, ariseth from the inner corner of the Eye and that part of the *supercilium* that is next to the Nose, with a sharp beginning: from whence it passes transversely toward the outward corner, growing presently fleshy and broader, so that it filleth up all the space betwixt the Eyebrows and the lowest edge of the Eyelids on which the hairs grow, (which is called *cilium* or *tarsus*) and at length is inserted into the outer corner. That which moveth the lower (though but obscurely) in order to shut it, is membranous and thin, arising from the side of the Nose with a sharp beginning as the other; whence being carried transversely it comes to the middle of the Eyelid, where becoming something fleshy it continues its course to the outer corner which it turns about, and ascending to the upper Eyelid is inserted into it with a broad end. These two Muscles being contracted shut the Eye, the greater drawing down the upper Eyelid, and the less pulling up the lower.

Frontalis.

But it is to be noted that besides the *Rectus* aforesaid to open the Eye, there sometimes concur, when we would open them very wide, the
musculi

musculi frontales, (on each side one) which springing from the Skull near the coronal suture, and having one side knit to the temporal muscles, do meet one another with the other side upon the forehead, and descend with streight Fibres to the Eyebrows, where they terminate. By the help of these we draw up and wrinkle the forehead, and by consequence pull up the upper Eyelid a little. The skin grows very close to these Muscles.

CHAP. IV.

Of the Muscles of the Eye.

THESE are in number six; four *streight*, and two *oblique*. The *streight* move the Eyes upwards and downwards, to the right hand and to the left: the *oblique* move them obliquely. The *streight* are more thick and fleshy than the *oblique*. As to their beginning, (*viz.* of the *streight*) they have all the same origine; as to their progress, the same structure; and as to their end, the same insertion. Their *origine* is contiguous and acute, being at the hole through which the optick Nerve enters the orbit of the Eye, from whose Membrane they spring. Their *middle*, or Belly, is fleshy and almost round. Their *end* is a most thin and membranous Tendon, whereby they are inserted into the *tunica cornea*, where it is pellucid, near the *Iris*, and so do encompass the whole Eye before as far as it is white.

The streight muscles.

Their rise and insertion.

The

The first of the *streight* is called *attollens*, or *superbus*; that which pulleth up the Eye. The second is *deprimens*, or *humilis*, that which draweth down the Eye. The third is *adducens*, or *bitatorius*, that which pulleth the Eye to the Nose. The fourth is called *abducens*, or *indignatorius*, that which pulleth it from the Nose towards the outer corner.

The first is placed in the upper region of the orbit, the second in the lower, (opposite to the upper) the third in the inner corner of the Eye, the fourth in the outer.

The oblique
muscles.
Their rise
and inser-
tion.

The oblique Muscles are called *circumagentes*, winders or rollers about, and *amatorii*, or amorous; and are in number two. The first is *obliquus major*, or *superior*, the uppermost and largest. This beginneth within the orbit of the Eye, by the hole of the optick Nerve, and passing to the upper part of the inner corner of the Eye, endeth in a small and round Tendon, which passeth through a transverse cartilage there placed, (called by *Fallopins trochlea*) as a cord through a pulley, and is inserted into the upper side of the *cornea*. The second is *obliquus minor*, or *inferior*, the lowermost and smallest. This springeth from the lower and almost outer part of the orbit, about the chink which doth unite the first bone of the upper jaw to the fourth, with a carnous beginning. It is slender but not quite round, and passeth obliquely to the outer corner of the eye, which having turned about, it ends in a short, roundish and nervous Tendon, which meeteth with the Tendon of the other oblique Muscle, and is inserted in an oblique line near the *Iris* betwixt the Tendons of the
attollens

attollens and *abducens*, with the other, so that both seem to have but one Tendon. This bringeth the apple of the Eye to the Nose, as the other draweth it from it.

Before you shew the Muscles of the eye, cut off the fat with the scissers, then shew first the *obliquus major*, then the *obliquus minor*, and last of all the four streight Muscles. Nevertheless let the *obliquus major* remain last, when all the rest are taken away, that you may shew how the Tendon of it passeth through the pulley the more plainly. And it will not be amiss here to describe this same pulley or *trochlea*, which we shall do, out of *Spi- gelius*: It is a little round cartilage, hollowed like a pipe or piece of a straw, that is suspended by a Ligament in the inner corner of the eye, from which the said greater oblique Muscle has the name of *Trochlearis*.

Now these muscles are to be shewed.

Trochlea.

CHAP. V.

Of the Muscles of the Nose.

THE Nose is not all of it moveable, but only its lower gristly parts, which are called *Alæ* or *Pinnæ*. And these are either drawn together to shut the Nostrils, which is performed by the *adducens* Muscles; or drawn asunder to open the Nostrils, which is done by the *abducens*. And there are two Pair to serve each Office. So that in all there are Eight Muscles that belong to the Nose.

The

The abducent muscles.

The *first* Pair of the *abducent* or opening Muscles is small, rather Carnous than Membranous, arising from the upper Jaw-bone, near the first proper pair of the Lips; this is inserted partly into the lower part of the *ala* of the Nose, and partly into the upper part of the upper Lip, and is called *Philtrum*. The *second* pair covering each side of the Nose, begins at its top near the *foramen lachrymale*, with an acute and fleshy Origine, and descending obliquely by the bones of the Nose it ends in a broad Basis, and still remaining fleshy is implanted into the *Alæ*. It is near of a three-square or triangular shape, like the Greek Letter Δ *delta*, whence it is called by some *deltoides*. These two pair by drawing the *Alæ* upward widen and open the Nostrils.

The adducent muscles.

The *adducent* or closing Muscles are very small ones, so that they can hardly be discovered or distinguished exactly but in them that have large Noses. The *first* pair of these is *external* and fleshy, rising about the root of the *alæ*, which it ascends creeping transversely over them to the ridge or tip of the Nose, into which it is inserted. The *second* is *internal*, and is hid in the cavity of the Nostrils under the inner coat that covers them: it is membranous, and arises from the bones of the Nose, where they end about the gristles, and is inserted into the *Alæ*. The former being contracted depresses the *Alæ*; the latter draws them inwards, and so closes or constricts the Nostrils. And to the same end or purpose there is another that serves (which is common) namely the *orbicularis* of the upper Lip, which by drawing the Lip downwards, doth at the same time constrict the Nostrils.

Bar

Bartholin writes, that besides these Muscles, he has sometimes found a small carnosus Muscle reaching streight down from the frontal Muscle with a broad Basis, but presently growing narrower, to end about the cartilage of the Nose.

CHAP. VI.

Of the Muscles of the Lips and Cheeks.

THE Muscles of the Lips are either *common* to the Cheeks and Lips, or *proper* only to the Lips. The *common* are two on each side. The *first* is called *destrahens quadratus*: this is a thin but broad Muscle, resembling a Membrane enterlaced with fleshy Fibres. It hath its beginning from the *vertebræ* of the neck in the outer side, the shoulder-blade, the *clavicula* and the breast-bone, and mounting up by oblique Fibres to the face, is implanted in the Chin, Lips, and root of the Nose; which parts it draws obliquely downwards. Sometimes it proceeds also to the root of the Ear, and is reckoned for one of its Muscles. It is called *quadratus* or four-square from its shape. When a convulsion happens in this Muscle, it causes the *spasmus cynicus*, which we can imitate voluntarily by drawing down one side of the Mouth. The *second* is called *Contrahens*, or *Buccinator* the Trumpeter. This lieth under the former, in the upper part of it. It doth make up all that part of the Cheek which is blown up when a Trumpet is sounded. It is round, and springing from the brims of

The common muscles.
1. *Destrahens quadratus.*

2. *Contrahens.*

of the upper jaw-bone circularly, doth end in the brims of the lower jaw-bone. It is wholly membranous, and interlaced with divers Fibres, and is knit so close unto the Membrane which covereth the inside of the mouth, that it hardly can be severed from it. This Muscle is not only of use to move the Cheeks with the Lips, but when it is contracted, it turneth in the meat upon the Teeth again, that had got to betwixt them and the Cheek, in chewing of it.

The proper muscles.

1. *Attollens.*

2. *Abducens.*

3. *Jugale.*

4. *Deprimens.*

The Muscles *proper* to the Lips, are five pair, and one odd one. First, *par attollens*. If both of these act together, they draw all the upper Lip directly upwards and outwards; but if only one, then is but one side of the Lip drawn up obliquely. This pair springeth from the first bone of the upper-jaw, or *os jugale*, where the Ball of the Cheek is. At its rise it is broad and fleshy: from thence marching obliquely to the fore-part, each is inserted into its own side of the upper Lip near to the Nose. The Second is called *Abducens*, and assisteth the motion of the former, or rather draweth the upper Lip more to one side. It riseth out of the Cavity that is under the Ball of the Cheek with a fleshy but slender and round beginning, and being covered with much Fat, it is implanted into the *frænum* or little dimple in the middle of the upper Lip. The third pair is called by *Riolanus* *Zugomaticum* or *Jugale*, arising outwardly from the Jugal Process. It is fleshy and round, and descending obliquely through the Cheeks, is terminated near the corner of the Mouth on each side; and serves to draw both Lips upwards sideways; for it is common to them both. The fourth pair is *Deprimens*, which pulleth down the

the lower Lip. It springeth from the sides of the Chin, where the two small bunchings are: there it is fleshy. From thence marching obliquely, it is inserted into the middle of the under Lip. It is every where broad. The fifth pair may be called *oblique detrahens*, for it draws the lower Lip obliquely downwards and outwards. It springs from the sides of the lower Jaw with a fleshy and broad beginning, (being sometimes extended to the middle of the Chin) from hence it goes upwards, and growing narrower by degrees it is inserted obliquely into the lower Lip near its corner. Some make but one of this and the immediatly foregoing; as also of the second and third, but they are indeed distinct. And these are all of them pairs, one on each side: but this which follows is single, namely the *Orbicularis* or *Constringens*, and is common to both Lips. It is otherwise called *Osculatorius*, because it contracteth the Lips in kissing. This is that which makes the proper figure and soft substance of both the Lips, encompassing the whole Mouth like a Sphincter, which by its orbicular Fibres it constringes or purfes up when one is said to simper. It is closely knit to the red skin of the Lips.

s. Oblique
detrahens.

Constringens.

CHAP.

CHAP. VII.

Of the Muscles of the lower Jaw.

*The lower
jaw hath
five pair of
muscles.*

THE lower Jaw (for the upper is immoveable, and therefore has no Muscles) is moved upwards, downwards, towards the right side, towards the left side, and towards the back-part. To procure these motions five pair of Muscles are appointed, of which there is only one pair that draweth the Jaw downwards, all the others in some measure upwards: whence one may be easily made to shut his Mouth, there being only one pair of Muscles to oppose; but it is difficult to open it against ones will, through the great strength of the Muscles that shut it.

1. Temporalis.

The first pair of Muscles is called *temporalis*, and is the strongest and largest: It springeth from the bones of the *frons*, *synceput*, temples and *sphenoides*, with a fleshy, large and semicircular beginning, and on its outer side is covered with the *pericranium*, its inner lying next the *periosteum*. Its Fibres the further they are from its middle, the more obliquely are they carried towards its Tendon, for the further it descends, the narrower (but thicker and more carnous) it grows; and at length passing under the *os jugale*, it embraceth and is inserted into the acute process of the lower Jaw (called *maxilla*) with a short but very strong Tendon. *Spigelius* says, this Tendon is extended through the whole Muscle, in its middle fleshy substance. Wherefore if this Muscle be wounded, fear-

fearful symptoms ensue, partly because the Tendon passeth so; partly because it is covered with the *pericranium*. This Muscle forcibly pulleth up the lower Jaw, and so shutteth the Mouth. The Second pair is called *deprimens, digastricum*, or *biventre*, because it hath two bellies, between which a Tendon lyeth: this doth pull down the Jaw, and so openeth the Mouth. Wherein it is partly assisted by the *Quadratus* described in the foregoing Chapter. It hath its beginning from the process of the bone of the Temple, called *Styloides*, where it is nervous and broad; and afterward becoming fleshy, small, and round, it passeth downward, and in its middle, where it comes to the flexure of the lower jaw-bone, it loseth its fleshy substance, and degenerates into a nervous and round Tendon; but by and by it becomes car-nous again, and goes along the inner side of the lower-jaw, to its forepart that is under the Chin, where it is inserted. The third is called *masseter*, because it serveth for chewing by moving the Jaw to the right and the left side: from its situation it may be called *laterale*. This hath two beginnings: one is nervous, springing from the suture where the first bone of the Jaw is joyned to the fourth. This beginning is large and strong. The other beginning is fleshy, proceeding from the *os jugale*, and so marcheth towards the Chin, and is implan-ted into the whole breadth of the lower Jaw strongly. The Fibres of this Muscle, by reason of the two beginnings, cross one another; so that these Muscles do not only move the Jaw laterally, but backward and forwards also.

The fourth pair is called *pterygoideum externum*, *aliforme externum*, or *maxillam abducens*. This hath also

Why the wounds of the tempo-
ral muscle are danger-
ous.

2.
Deprimens
or biventre.

3.
Masseter or
laterale.

4.
Aliforme
exter-
num, or
maxillam
abducens.

also a double beginning, partly nervous and partly fleshy ; springing partly from the upper external sides of the wing-like process of the *os sphenoides*, partly from the rough and sharp line of the same bone. Whence marching down by streight Fibres, it becometh greater and thicker. And at length is inserted by a strong Tendon into the internal lateral part of the lower Jaw, which is under the Tendon of the temporal Muscle. This moveth the Jaw forward, which appeareth when the lower Teeth are stretched further out than the upper.

5. The fifth pair is termed *maxillam adducens*, or *pterygoideum internum*. This draweth the Jaw towards its head, or backward. This, in the beginning being nervous, doth spring from the inner cavity of the wing-like Process of the *os sphenoides*; then becoming fleshy, large and thick, and marching down by a streight passage, it is inserted into the inner and hinder part of the lower Jaw by a nervous, broad and strong Tendon. Besides its more proper Action of drawing the Jaw backwards, it also helps the temporal Muscle to draw it up.

5.
Alitornine
internum,
or maxil-
lam addu-
cens.

CHAP. VIII.

Of the Muscles of the Ear.

THE Ear consists of an *outer* and an *inner* part : and each has its proper Muscles.

The *outer* part is moved but very obscurely, because in Men the Muscles are exceeding small ; so that *Galen* calls them, only lineaments or resemblances of Muscles. There are four of them, which by their situation seem fit to move this *outer* part of the Ear (called *auricula* by *Spigelius*, to distinguish it from the *inner* part called *auris*) four manner of ways.

The auricula hath four muscles.

The first is called *astollens*. This is seated in the fore-part of the Face, and lies upon the temporal Muscle that draws up the lower Jaw. It arises at the outer end of the frontal Muscle (where it is contiguous to the temporal) with a thin and membranous beginning, but by degrees becoming narrower as it goeth down, it is inserted into the upper part of the Ear, which it moveth upwards and forwards. The second is called *dearabens*. This ariseth broad and carnosous from the mammillary Process, and growing narrower is inserted into the root of the cartilage of the Ear sometimes by two, sometimes by three Tendons. It draweth the Ear upwards and backwards. The third is called *adducens ad anteriora*, whereby the Ear is drawn forward and downward. This is but a particle of the *musculus quadratus*, that pulleth down the Cheeks, described before, which ascend

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2.

3.

4. cending with its Fibres, is implanted into the roof of the Ear. The fourth is *abducens ad posteriora*, which draws the Ear backward. This hath its beginning in the back-part of the Head, from the Tunicles of the Muscles of the *occiput*, above the *processus mammillaris*, where it is narrow, but waxing broader it is carryed downward transversly, and is inserted into the Ear behind. All these Muscles in Horses, Oxen and the like, are very large to what they are in Men (yea they have more than these) whereby they can move their Ears more strongly and apparently, to shake off Flies or any thing that offends them.

The auris
1799.

I.

In the *inner* part of the Ear (called *Auris*) there are two. The first is called *externus*. It is small, springing pretty broad from the upper part of the passage of the Ear; then becoming narrower it grows into a very fine and small Tendon, which is carryed on the outside of the Membrane, called *tympañum*, till it arrive at its centre or middle, into which it is inserted, just there where on the inside of the said membranè the little Bone called *malleus* sticketh, which with the Membrane this Muscle draweth a little outward and upward.

2.

The second is called *internus*. This is very small, and is placed within the *os petrosum*. It hath its beginning in the *basis* of the wedge-like Bone, there where it is joined with the *processus petrosus*, and at about its middle it is divided into two small Tendons, whereof the one is inserted into the upper process of the *malleus*, and the other into the neck of it. This draws the head of the *malleus* obliquely forward, and pulls it inward from the *incus*.

- them act together, they draw the tip of the Tongue streight upward and backward to the Palate and upper Teeth; if but one, that it draws it obliquely upward toward its own side. The
4. fourth is called *Ceratoglossum*, because it ariseth from the two horns of the *os hyoides*. It is inserted into the sides of the Tongue. If both of these be contracted at once, they draw the Tongue streight downward and inward; but if only one, then is the Tongue drawn obliquely to that side. The
5. fifth pair is called *Styloglossum*, because it ariseth from the *styloides processus*; from which springing fleshy and small, but afterwards becoming broader and thicker, it is inserted into the sides of the Tongue, at about the middle of its length. If both these act together, they pull the Tongue upward and inward; but if one only, then to the right hand or to the left.

CHAP. X.

*Of the Muscles of the Bone of the Tongue,
called os Hyoides.*

THIS Bone is moved upwards, downwards, forward, backward, and toward the sides, as the Tongue is; for it is moved according as the Tongue is, seeing it is joined to it, and its Muscles are common to both.

*Os hyoi-
des hath
four pair.*

I.

To perform these motions it hath four pair of Muscles. The first is called *Sternohyoideum*. This springing from the upper, but inner part of the

the *sternum* with a broad and carnous beginning, and ascending under the Skin of the Neck by the Wind-pipe, itill keeping the same largeness and substance, is inserted in the root or *basis* of the *hyoides*, which it moveth (and the Tongue with it) downward and backward. The second is opposite to this, and is called *geniobyoidenm*. This springing from the inner part of the Chin, (by the *genioglossum*) fleshy and broad, is inserted into the upper part of the root of the Bone, where a cavity is made to receive it, and draweth it streight upwards and a little forwards. The third is *Coracobyoidenm*. It riseth from the upper side of the *scapula* near the *Coracoides processus*, having a carnous beginning, and passing under the *Levator* of the shoulder-blade, called *musculus patientie*, it ascends under the *par mastoides* that bends the Head, where it loses its fleshy substance, as giving way to one more worthy than it self, and degenerates into a nervous and round Tendon. But as soon as it is past this, it becomes carnous again, and so continues till it is inserted into the horns of the *hyoides*. Considering its slenderness it is the longest Muscle of the Body, and has two Bellies like the *par deprimens* that pulls down the lower Jaw. It pulleth the Bone obliquely downwards. The fourth is *styloceratobyoidenm*. This riseth from the root of the *processus styloides*, and endeth in the horns of the *hyoides*, which it draweth obliquely upward.

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3.

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CHAP. XI.

Of the Muscles of the Larynx.

The common muscles are four.

I.

2.

The proper muscles nine.

I.

THE Muscles of the *Larynx* are either *common* or *proper*. The *common* are four; two called *par sternothyreoidæum*, and as many called *par hyothyreoidæum*. The *Hyothyreoidæum* springeth from the whole *basis* almost of the Bone of the Tongue, having a broad and carnous beginning; from whence descending with streight Fibres, and covering all the outside of the cartilage *thyreoides*, it is inserted into its lowest part. When this is contracted, it draws the buckler-like (or *thyreoides*) cartilage upwards and inwards, and thereby straitens the Chink of the *Larynx*. The other pair called *sternothyreoidæum* (vulgarly *Bronchium*) springing from the upper and inner part of the *sternum* with a carnous and broad beginning, ascends with streight Fibres up by the sides of the Wind-pipe (continuing the same largeness and substance) and is at last inserted into the lower side of the buckler-like cartilage, by drawing down which it opens or widens the Chink. *Diemerbroeck* assigns clear contrary actions to these Muscles, *viz.* that the former widens and this latter straitens the *rima* of the *Larynx*.

The *proper* Muscles are in number nine. The first pair is called *Cricothyreoidæum anticum*. This springeth from the fore-part of the *cricoides* or ring-like cartilage, and is inserted into the lateral parts of the *Thyreoides*. It extends the cartilage and so widens

widens the *rimula*, for the forming of a big Voice. *Bartolin*, from the insertion of the Nerve, says it arises from the *thyreoides*, and is inserted into the *cricoides*. Also if this pair be very broad, he says, it may be divided into two pair (which *Riolanus* has done) and then the second may be called *Cricothyreoides laterale*. The second pair is called *Cricoarytenoideum posticum*, springing carnos from the hinder and lower part of the *Cricoides*, whose cavity it fills, and ascending with streight Fibres it is inserted with a nervous end into the lower side of the *Arytenoides*, which it pulls upward and backward, and thereby opens and widens the *Larynx*. The third is *Cricoarytenoideum laterale*, which springeth above from the sides of the *Cricoides*, with a slender beginning, but growing presently larger, it is implanted into the sides of the *arytenoides*, in that part that the foregoing did not cover. This openeth the *Larynx* by drawing the cartilages obliquely aside. The fourth pair is called *Thyreocarytenoideum*. This is internal, carnos and broad, arising from the fore interior part of the *Thyreoides*, and is inserted into the sides of the *guttalus* or *arytenoides*, which make the *glottis*. It draws these Cartilages one to the other and so straitens the *Larynx*. The fifth and last is reckoned to be but one Muscle, and is called *Arytenoides*, because it has its rise from the Cartilage so called, namely from its hinder Line, from whence being extended with transverse Fibres, it is also inserted into its sides, and by constringing of it shuts the *Larynx*.

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CHAP. XII.

Of the Muscles of the Uvula and Throat.

*The Uvula
said to
have two
muscles.*

THE *Uvula* is said by *Veslingius*, *Riolanus*, &c. to have two Muscles to hold it up; of which one is called *Pterygostaphilinus externus*, which springeth from the upper Jaw, a little below the furthestmost Grinder, and is inserted into the side of the *Uvula*: The other *Pterygostaphilinus internus*, proceeding from the lower part of the internal wing of the *pterygoideus Processus*, and inserted into the *Uvula* in like manner. But these Muscles are very hard to discover: and indeed there seems no occasion for them, seeing the *Uvula* has no apparent motion, and its own frame seems sufficient to suspend it.

*The throat
hath seven.*

- The Throat, or the beginning of the *oesophagus*, called *pharynx*, hath seven Muscles, to wit, three pair and a sphincter. Of the pairs, the first is *Sphenopharyngæum*. This springeth from the sharp point of the *sphenoides* with a small and nervous beginning, and passing downward, ends in a fine Tendon, which is inserted obliquely into the lateral parts of the Palate and *Pharynx*, which it widens in swallowing. The second pair is called *Cephalopharyngæum*, and springeth from that part where the Head is joined to the first *vertebra* of the Neck, and marching down it is spread about the *Pharynx* with a large *plexus* of Fibres, and seemeth to make its Membrane. This straitens the Throat in swallowing. The third is *Stylopharyngæum*. This spring-
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 - 2.
 - 3.

springing from the *styloides* Process, is inserted into the sides of the *Pharynx* to dilate it. That which hath no fellow is called *œsophagiæus*, which springing from one side of the *thyreoides*, and circularly compassing the *Pharynx* with transverse Fibres, is inserted into the other side of the *Thyreoides*; and serves to contract the Mouth of the Gullet, as the *sphincters* of the *anus* and Bladder do those parts.

4.

CHAP. XIII.

Of the Muscles of the Head.

THE Muscles of the Head are either *common*, or *proper*. The *common* are those which together with the Neck move the Head. These are to be described in the next Chapter. The *proper* are those which only move the Head when the Neck remaineth unmoved, and these are in number sixteen, or eight pair. The first pair called *Mastoideum* bend the Head forward, if both act together; but on one side obliquely, if but one. These have each a double beginning; one nervous from the top of the *sternum*, the other carnous from the upper side of the *clavicula*; which origines joining, it becomes wholly carnous, and ascending obliquely by the Neck, at last is inserted with a carnous end at the hinder part of the Head into the Process called *Mastoides*, or *mammillaris*. This is the only pair that is placed in the fore-part and bows the Head forward; all the rest are seated behind, and bend it backward or to the sides. Of which

The common.

The proper are eight pair.

I.

2. which the first pair is called *splenium* or *triangulare*. It rises with a nervous beginning from the five uppermost *vertebrae* of the *Thorax*, and five lowermost of the Neck; from whence ascending and becoming thick and carnous, it is implanted into the *occiput* with a broad and fleshy end. If both the Muscles of this pair act together, they draw the Head directly backward; if one singly, then a little to one side.
3. The second is called *complexum* or *trigeminum*, because it has so plainly a threefold beginning, that it seemsto be compounded or made up of three Muscles. One beginning is from the transverse Process of the fourth and fifth *vertebrae* of the Breast, a second from the first and second of the same, and a third from the spine of the seventh *vertebra* of the Neck: All which in their ascent being united into one, are inserted into the *occiput* sometimes by one and sometimes by a triple Tendon. This has the same action with the foregoing, as have also the three following.
4. The third pair is called *parvum & crassum*, because it is small and thick. This lyeth under the second pair. It arises nervous from the transverse Processes of the six uppermost *vertebrae* of the Neck, and is inserted into the hinder root of the mammillary Processes. The fourth pair is *rectum majus*. These springing from the edge of the second *vertebra* of the Neck, are inserted into the *occiput*.
5. The fifth, *rectum minus*. These lye under the former, and proceeding from the back-part of the first *vertebra* end into the *occiput*.
6. The sixth is *obliquum superius*. This pair lies under the two *recta*, answering to them in substance and form. It springs from the Process of the first *vertebra* of the Neck, and is implanted into the *occiput* by the outer side of the
- 7.

the *recta*. Some say its rise is here, and its insertion into the *vertebra*. The seventh, *obliquum inferius*. This is longish, fleshy and round, rising from the spine of the second *vertebra* of the Neck, and is inserted into the transverse Process of the first *vertebra* of the same. These oblique Muscles serve to turn the Head about.

8.

CHAP. XIV.

Of the Muscles of the Neck.

THE Head is not only moved by the proper Muscles abovesaid primarily, but secondarily also by these of the Neck, which are eight in number, on each side four. The first and second pair bend the Neck backward, or obliquely; the third and fourth forward, or to one side, as both or one act. The first is called *Spinatum*. This proceeding from the *spinæ* of the upper seven *vertebræ* of the *thorax*, and of the five lowest of the Neck, is inserted strongly into the lower edge of the second *vertebra* of the Neck. The second, *Transversale*. This rising from the transverse Processes of the six upper *vertebræ* of the *Thorax*, is inserted outwardly into all the Processes of the *vertebræ* of the Neck. The third, *longum*. This being placed under the *æsofagus*, doth spring from the fifth and sixth *vertebra* of the back, and as it ascends is knit to the sides of all the *vertebræ*, till it come to the first or highest of the Neck, where each touching other, they are both inserted

The neck
hath four
pair.

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3.

ted

4. ted into its Proceſs. The fourth, *triangulare*, or *scalenum*. It proceeds carnous from the firſt rib, and is inſerted into the inſide of all the tranſverſe Proceſſes of the Neck, except ſometime the firſt and ſecond. It is perforated to make way for the Veins, Arteries and Nerves which paſs to the Arms.

CHAP. XV.

Of the Muſcles of the Breſt.

*The dilata-
ters.*

- HAVING done with the Muſcles that belong to the Head, the higheſt *Venter*, we come now to thoſe of the middle or *Thorax*, which aſſiſt reſpiration. Of theſe ſome dilate the Breſt in inſpiration, ſome contract it in expiration. Of the Dilaters the firſt is called *par Subclavium*. This ariſeth fleſhy from the inner part of the *clavicula*, and paſſing obliquely is inſerted into the firſt Rib, near to the *Sternum*. The ſecond is *ferratum majus*. This doth ariſe from the inſide of the Shoulder-blade, and the two upper Ribs, and is inſerted into the lower five true Ribs, and two upper ſhort Ribs, before they end into cartilages. It is called *ferratum* or Saw-like, becauſe its unequal *extremities* being intermixed with the like unequal *beginnings* of the obliquely deſcending Muſcle of the *Abdomen*, imitate the Teeth of a Saw. The third is *ferratum poſticum ſuperius*. This lying under the *rhomboides*, ſpringeth membranous from the ſpines of the three lower *vertebrae* of the Neck, and

and of the first *vertebra* of the Back, and is inserted into the three or four upper Ribs. The fourth is *serratum posticum inferius*. This ariseth from the spines of the three lowest *vertebrae* of the Back, and of the first of the Loyns, and is inserted into three or four of the lowest (short) Ribs. Fifthly, *The eleven external intercostals*, which perform the office but of one Muscle. These spring from the lower part of the upper Rib, and are inserted into the upper part of the lower Rib obliquely.

There is another Muscle besides these, that assists the widening of the Breast, namely the *Diaphragm*: but of it we spoke at large in *Book 2. chap. 3.* where the Reader may find its Description and Use.

These that follow contract the Breast. First, *The contr. par triangulare*. This arising from the middle Line of the *sternum*, is inserted into the bony ends of the third, fourth, fifth and sixth true Ribs (where they are joined to the Cartilages.) The second is *sacrolumbum*. This arises from the *os sacrum*, and the Processes of the *vertebrae* of the Loins; and ascending up to the Ribs, is implanted into each of them in their lower side, about three Fingers breadth from the spine, by a particular Tendon. (*Diemerbroeck* describes another pair opposite to this (which he calls *cervicale descendens*) springing from the third, fourth, fifth, sixth and seventh *vertebrae* of the Neck, and is inserted into the upper side of each Rib as the *sacrolumbum* is into the lower. And says, that this pair by pulling the Ribs upwards in inspiration widens the Breast, as the other by drawing them down in expiration straitens it.) Thirdly, *The eleven internal intercostals*, which are as one Muscle. These pass

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The contr. tracters.

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pass obliquely from the lower to the upper Rib. Their Fibres run opposite to those of the external, representing a St. *Andrew's Cross*, or the Letter X.

These Muscles are much assisted in their action, secondarily, by the Muscles of the *Abdomen*, *scapulae* and Arms.

CHAP. XVI.

Of the Muscles of the Back and Loins.

The back
and loins
have four
pair.

1.

THE Back, but especially the Loins being moved diversly, viz. backward and forward and to the sides, into every *vertebra* there are Tendons of the Muscles inserted, as if there were a great many Muscles in all. But there are but four (proper) pair to assist the motion of both. The first pair are two triangular Muscles, which being joined together make a kind of a quadrature, and are therefore called *par quadratum*. These arise broad and thick from the hinder upper cavity of *os Ileum*, and the inner side of *os sacrum*, and are inserted into the transverse Processes of the *vertebrae* of the Loins even up to the lowest Rib. If both these act together, they bow the *vertebrae* of the Loins streight forward, if one alone, obliquely forward. The second and principal pair are the *musculi longissimi*, which springing at the bottom of *os sacrum* and *Ileum*, and ascending up the spine, reach as far as to the *processus mammillares* near the Temple-bones, beltowing
Ten-

2.

Tendons on the Processes of all the *vertebrae* of the Loins and Back, (whence some have divided this pair into as many as there are *vertebrae*) being almost confounded with the two following from their rise till the lowest *vertebra* of the *Thorax*, where this pair begins to be separated from them. And hence because these three Muscles are something hard to separate, some account them for one. The third pair are the Muscles called *sacri*, which arise behind from the *os sacrum*, with an acute and fleshy beginning, and end in the spine of the lowest *vertebra* of the *thorax*, and for the most part also are inserted, by the way, into the spines and oblique Processes of the *vertebrae* of the Loins. This pair helpeth the action of the former. The fourth and last pair are the *semispinati*, which springing by a nervous beginning from all the spines of *os sacrum* and the Loins, end in the transverse Processes of the *vertebrae* of the Loins, and of the lowermost of the *Thorax*. This pair erects the *Thorax*.

3.

4.

Now there are none of these Muscles but the first pair, that bend the Loins and Back forward; but these are much assisted in that action by the *recti* of the *Abdomen*, which we shall describe in the next Chapter.

CHAP. XVII.

Of the Muscles of the Abdomen.

IN the first Book, Chap. 3. where we discoursed of the common containing parts of the *Abdomen*, or lowest Venter, we only barely mentioned its Muscles, deferring the further description of them till this place, where it seems more proper.

The Abdomen hath five pair.

The *Abdomen* then hath ten Muscles, five on each side. The first pair is *oblique descendens*. Its rise is parted into seven or eight fleshy Portions, like Comb-teeth, which being intermixed with the Tendons of the *serratus major* of the Breast divided in like manner imitate a Saw. It springeth from the lower side of the sixth, seventh, eighth, ninth, tenth, and eleventh Ribs, and the transverse Procellæ of the *vertebræ* of the Loins, adhering also to the edge of *os Ilium*; from all which places its Fibres descend obliquely, and it endeth by a broad Tendon in the middle of the Belly in the *Linea alba*; which Tendon cleaves so fast to that of the obliquely ascending (lying next under this) that they cannot be separated without tearing. (The *Linea alba* in which these Tendons end, is a white part or Line running from the *mucronata cartilago* at the pit of the Stomach down the middle of the Belly by the Navel to the *ossa pubis*, and is made of the concurrence of the Tendons of the Muscles of the *Abdomen*; namely of this pair already mentioned, and of the *oblique ascendens*, the

the transverse and pyramidal. The second pair is the *oblique ascendens*. These lye next under the former, and their Fibres ascending obliquely cross those of the other like an X. They spring from the transverse Processes of the *vertebrae* of the Loins and the spines of *os sacrum* with a membranous beginning, and from the edge of *os Ilium* with a fleshy. Ascending carnosus from hence they are joined to the cartilages of the eighth, ninth, tenth and eleventh Ribs, and end in the *linea alba* with a broad and nervous Tendon. The third pair is the *rectum* or streight. These arise fleshy from the lower part of the *sternum*, from both sides of the *cartilago mucronata*, and from the cartilaginous ending of four Ribs; and so marching streight down along the Belly, it is inserted by a strong Tendon into the *ossa pubis*. Each hath sometimes three, sometimes four transverse inscriptions or interfections, that appear tendinous: whence some divide them into four or five Muscles, accordingly as they have three or four Interfections. And indeed if *Galen's Rule* be true, that wheresoever the Nerve is inserted into the Muscle, *there* is its head; we must confess they are distinct Muscles. For Nerves are inserted into both their upper and lower parts, and into each of those that lye betwixt the Interfections. And by supposing them thus distinct, we may conceive how they may better perform their primary action, which is strongly to compress the Belly for the expulsion of the *faeces* or *fetus*. Under these Muscles do the *Arteriae* and *Venae mammariae* descend to about the Navel, as the *Arteriae* and *Venae epigastricae* ascend under them to near the same place; and these were held to inosculate one with

2.

3.

- another, (the descending with the ascending) till of late that such inosculation is discovered to be merely imaginary. The fourth pair is the *pyramidal*. These are placed above the lower part of the *musculi recti*. They spring from the *ossa pubis*, small and carnosus, where they receive their Nerves. They are broader at their basis, and grow narrower as they ascend, whence they have their name of *pyramidal*. They climb up upon the *recti* about four Fingers breadth (the left being shorter and narrower) and insert their acute Tendon into the *linea alba*. They are said to assist the *recti* in their action, and are for that reason also called *succenturiati*. But they seem more particularly to serve to compress the Bladder in making Water. Sometimes one, and sometimes both of these are wanting, and then the ending of the *recti* is broader and more carnosus. The fifth pair is the *transverse*, which is firmly knit to the *peritonæum*, and whose Fibres run cross or athwart the Belly. They spring from a Ligament that grows from the transverse Processes of the *vertebrae* of the Loins, from *os Ileum*, and the cartilaginous ends of the lower Ribs, (having the same Arteries, Veins and Nerves with the obliquely ascending) and end in a broad and membranous Tendon in the *linea alba*. The use of all these Muscles hath been held to be, first, while the Body is at rest, to strengthen the parts subjacent, and to encrease their heat: and secondly, when they are in action, first, to further the excretion of the Excrements; secondly, to help the delivery of the Infant in labour; thirdly, to assist the Breast in strong expiration and expectoration; and fourthly; to help to bend the spine in stooping, &c. Diemerbroeck

broeck thinks that the streight, pyramidal and transverse do serve for the compression of the Belly, but that the oblique do elevate or dilate it; for in inspiration the *Abdomen* is elevated as well as the *thorax*: and an alternate elevation and depression seems necessary for the furthering the motion of the Aliments and Humours through the Parts contained in the lower Belly.

CHAP. XVIII.

Of the Muscles of the Genitals, both in Men and Women.

IN the first Book, *chap. 23. of the Yard*, we described its Muscles and their action, whither the Reader may please to turn, and here we shall but just name them. They are two pair. The first are the *erectores* or *directores*, which arise from the inner knob of the *coxendix*, and are inserted into the nervous Bodies of the *Penis*. The second are the *acceleratores*, which arise from the *sphincter* of the *anus*, and passing on the under side of the *Penis* (by the sides of the *urethra*) end about its middle.

The penis hath two pair.

The *Clitoris* in Women, (something resembling the *Penis* in Men) hath also two pair of Muscles, which having described *Book 1. chap. 29.* we shall not insist on here, but remit the Reader thither.

The clitoris hath also two pair.

As to the *Cremaster* Muscles by which the *Testes* are suspended in Men, see them described *Book 1. chap. 31.* As for Womens *Testes*, they have no *Cremasters*.

CHAP. XIX.

Of the Muscles of the Bladder and Anus.

The bladder hath one muscle.

THE Bladder hath but one Muscle, called *sphincter*, which doth compass round its Neck, and the *prostates*. In Men it is about two Inches broad, and is nothing else but the middle membrane here grown more carnosus than in the rest of the Bladder. Its Fibres are orbicular, whereby it constringes or purses up the Neck of the Bladder, that the Urine cannot pass out without a voluntary relaxing of this Muscle. In Women it reacheth to the Hole by which the Urine passeth into the *vagina uteri*, and seemeth to form it.

The anus three.

The *Anus* hath three Muscles. The first is *sphincter*: this is fleshy, and encompasses the end of the streight Gut, being two Inches broad. Its Fibres are orbicular. It doth not spring from any adjacent Bone, but only adheres to the *coccyx*. It serves to purse up the Fundament. The second and third are called *levator*es. These spring from the Ligaments of the *coxendix* and *os sacrum*, being broad and membranous, from whence passing by the sides of the streight Gut, they stick to it, and are inserted into the upper part of the *sphincter*. These hinder the falling out of the Fundament, which sometimes happens when they are too much relaxed.

CHAP. XX.

Of the Muscles of the Scapula or Shoulder-blade.

THUS we have done with the Muscles of all the three *Venters* : now we come to those of the Limbs. And first of the *Scapula* or Shoulder-blade. It is moved forward, backward, upward and downward. Each *Scapula* hath four proper Muscles. The first is called *trapezius* or *cucullaris*, because it with its fellow covering the Back resembles a Monk's Cowl. It hath its beginning from the lower part of the *occiput* towards the Ear, fleshy ; but from the posterior Processes of five *vertebræ* of the Neck, and the eight upper *vertebræ* of the Breast, it springeth membranous and broad, and growing narrower in its progress, is inserted into the whole spine of the *Scapula*, the top of the Shoulder, and broader part of the *clavicula*. The second is *levator*, or *patientia musculus*. This hath its beginning from the transverse Processes of the first, second, third and fourth *vertebræ* of the Neck ; which beginnings being united about the middle of the length of the Muscle, it is inserted into the upper corner of the Shoulder-blade. The third is *serratus minor anticus*. This lies under the pectoral Muscle, and springs from the four uppermost Ribs (except the first) before they become cartilaginous, by four fleshy portions representing the Teeth of a Saw, and is inserted by a broad Tendon near to the Anchor-like Process of the *Scapula*.

The scapulae have four pair.

1.

2.

3.

4.

The fourth is *rhomboides*. This is placed immediately under the *cucullaris*. It springeth fleshy from the hinder Processes or spines of the three lowest *vertebra* of the Neck and so many uppermost of the Breast; and is inserted by as broad a fleshy ending, as the beginning was, into the *basis* of the Shoulder-blade.

These are the four *proper* pair of Muscles belonging to the *Scapulae*: Of which the first pair, because of its several Origines and several Fibres, moves them diversly, upward, or downward, streight backward, or obliquely, according as these or those Fibres are contracted. The second draws them (with the Shoulders) upwards; the third forward toward the Breast; and the last a little upward and backward.

It hath other Muscles that are *common* to it with other Parts, which in some measure assist its Motions, as the *serratus major*, described above, *chap. 15.* and the *deltoides*, which we shall describe in the next Chapter.

CHAP. XXI.

Of the Muscles of the Arm.

THE Arm in common acception is meant of all the distance betwixt the top of the Shoulder-blade and the Wrist; but we take it more strictly here for that part only that reaches from the Shoulder to the Elbow, (which it self is otherwise called *humerus*) and consists of one Bone, which we shall call the Shoulder-bone. It hath five motions, for it moveth backward, forward, upward, downward and circularly.

Each Arm
hath nine
muscles.

It is moved upward by two Erectors, *deltoides* and *supraspinatus*. First, *deltoides* (so called because in shape it resembleth the Greek Letter *Delta* Δ) springeth nervous and broad from the middle of the *clavicula*, the top of the Shoulder, and the whole spine of the *scapula*, and is extended as far as to the middle of this Shoulder-Bone, where it is inserted. This besides its raising up the *humerus*, helps also to draw up the *Scapula*. The second is *supraspinatus*, or *superescapularis superior*. This arises from the *basis* of the *Scapula*, and fills up all that cavity that is betwixt its spine and upper Edge, and passing over the jointing of the *Scapula* with the Shoulder-bone, by a broad and strong Tendon is inserted into the Neck of the latter. Some think this doth not only lift the Arm upward, but help to turn it round.

Erectors.
1.

2.

It is pulled down by *latissimus*, and *rotundus major*. *Latissimus* is so called from its largeness; for

Depressors.
1.

with

with its fellow it covereth almost the whole Back. It is called also *ani scalptor*, or *terfor*; for without it those Offices could not be performed. It springs by a broad membranous beginning from the hinder Processes of all the *vertebrae* of the Back-bone, that are betwixt the sixth of the *thorax*, and the middle of *os sacrum*, as also from the upper part of *os ilium*: then passing upwards, when it is come to that part of the Back, where the Ribs begin to bend, it becometh fleshy, and is carryed over the lower corner of the *scapula*; where becoming narrower, it is inserted under the upper head of the Shoulder-bone, by a short broad Tendon, between the *musculus pectoralis*, and this that follows, *viz.* *Rotundus major*, or more properly, *teres major*. (For *rotundus* means a thing spherical, but *teres* long and round, like a Thread, as this is.) It springeth carnos from the whole lower *costa* of the *scapula*, and is inserted by a short and strong Tendon into the Shoulder-bone, a little below the Neck of it.

Movers
forward.

1.

It is drawn forward by *pectoralis* and *coracoideus*. *Pectoralis* hath a very large and for the greatest part membranous beginning, arising from divers parts, yet is one and continuous. In its upper part it rises from the middle of the *clavicula* on that side next the Breast; in its middle, from the whole length of the *sternum* and the cartilages of the Ribs annexed to it; in its lowest, from the cartilages of the sixth, seventh, and eighth Ribs. It presently becomes carnos and thick, but narrower, and running towards the Shoulder it is inserted into the Shoulder-bone, a little below its Head, between the *deltoides* and the *biceps* of the Cubit. *Coracoideus* beginneth at the *coracoides* Pro-

2.

cess

cells of the *Scapula*, and endeth about the middle of the Shoulder-bone.

It is moved backward by three: *Infraspinatus*, *Subscapularis*, or *immersus*, and *Rotundus minor*. *Infraspinatus* or *suprascapularis inferior* springeth from the lower basis of the *Scapula*, and filleth up all that space that is betwixt its spine and lower edge, as the *supraspinatus* did that between the spine and upper edge. It is inserted by a broad and short Tendon into the fourth Ligament of the Shoulder-bone. *Subscapularis* or *immersus* possesseth the whole inner cavity of the *Scapula*. It springeth from the inner part of its *basis*, fleshy, and so continuing, passeth forward (but becoming still narrower) to the Neck of the *Scapula*, and at the last by a broad Tendon is inserted into one of the Ligaments of the Arm. *Rotundus minor* ariseth from the lowest corner of the *Scapula* by a fleshy beginning, and is implanted into the Neck of the Shoulder-bone. Some make but one Muscle of this and the *Rotundus major*.

As to the circular motion of the Arm, that is not performed by any particular Muscle, but several of these contribute towards it, namely the *supraspinatus*, *infraspinatus* and *subscapularis*, and in some measure the others also.

CHAP. XXII.

Of the Muscles of the Ulna.

THE lower part of the Arm from the Elbow to the Wrist is called *Cubitus*, which consisteth of two Bones, called *ulna* and *radius*. The *ulna* serveth for flexion, and extension; but the *radius* turneth it inward or outward, so as to make the back or palm of the Hand look upward or downward.

- Benders of the ulna.*
- I. The *ulna* is bended by two, to wit, *biceps*, and *brachialis internus*. *Biceps* hath two beginnings from the Shoulder-blade. The first is that which is outward, tendinous and round, springing from the upper brim of the hollowness of the *scapula*; The second is broader, and is framed partly of a Tendon, and partly of Flesh: it springs from the Anchor-like Process of the Shoulder-blade; then descending by the inner head of the Shoulder-bone, it meeteth with the former, and becometh a strong fleshy Muscle: which lying on the inside of the Arm, afterwards ends in a thick, round, and strong Tendon, which is inserted into the inner Prominence or knob of the *Ulna*. This is that Tendon which causeth great pain if it be pricked in Phlebotomy. *Brachialis internus* lyeth under the *biceps*, being shorter than it, and altogether fleshy. It riseth where the *deltoides* endeth, viz. from the middle of the Shoulder-bone, unto which it cleaveth firmly, and is inserted between the *ulna* and they *radius* where meet, in their fore-side.
 - 2.

The

The *ulna* is extended by four Muscles, *longus*, *Extenders*.
brevus, *brachialis externus*, and *cubitalis*. *Longus* I.

has two beginnings; the one is partly fleshy and partly nervous, at the lower brim of the *scapula*, near its Neck, (where it hath a peculiar hollow-ness to receive it:) this descends on the inside of the Shoulder-bone, and when it is come as far as the insertion of the *aniscaptror* (described in the foregoing Chapter) there arises another carnosus beginning towards the outer side, that (according to *Spigelius*) joins with it and makes up one Muscle, which is inserted into the inner side of the hinder Process of the *olecranus* (or gibbous knob of the *ulna*.) *Brevus* rising from the hinder part of the Neck of the Shoulder-bone, endeth in the outer side of the *olecranus*; namely, in that part of the Elbow that we lean upon. *Brachialis externus* (so called by *Riolanus* to distinguish it from, the *internus*) is placed on the outside of the Shoulder-Bone, and is confounded with the other two and endeth where they do. This seemeth to be *Spigelius*'s second beginning of the *longus*, which he says grows into one Muscle with it. *Cubitalis* 2.
or *anconæus* ariseth from the lower and hinder part of the Shoulder-bone, and passing by the jointing of the *ulna*, it endeth by a nervous Tendon in its lateral part about an Inch below the *olecranus* or *ancon*, whence it is called *anconæus*. Some make one Muscle of this and the *brevus*. 3.
4.

Note that both these benders and extenders of the *ulna* have only streight Fibres, and so only move the Cubit streightwise.

CHAP. XXIII.

Of the Muscles of the Radius.

THE *Radius*, the other Bone of the *Cubitus*, hath two sorts of Muscles: for some are called *pronatores*, such as turn it inwards, and the Palm of the Hand downwards; and some *supinatores*, which turn the *Radius* outwards, and the Palm of the Hand upwards.

The pronatores.

1.

2.

The *pronatores* are two in number. The first is, *pronator superior rotundus* or *teres*. This springeth from the Root of the inner knob of the Shoulder-bone, and from the inner side of the *ulna*, where it is joined to the Shoulder-bone; and running obliquely on the inside of the *Radius* endeth about its middle by a membranous Tendon. The second is *pronator inferior quadratus*, which is altogether fleshy. It springeth from the lower and inner part of the *ulna* two Inches broad; then marching transversely above the Ligament which joyneth the *radius* to the *ulna*, it endeth in the inside of the *radius*. The ending is as broad as the beginning; wherefore it is called *quadratus* or four-square.

Supinators.

1.

The *supinatores* are in like manner two. The first is *supinator longus*, so called, because of all the Muscles which march by the *ulna*, it hath the longest Belly. This springeth fleshy from the edge of the outer knob of the Shoulder-Bone; and marching obliquely under the *radius*, is implanted by a membranous Tendon into the upper part of the lower appendix of the *radius*, bending somewhat to

to the innerſide. The ſecond is *ſupinator brevis*. This ſpringeth from the outward part of the ligament in the jointing of the lower end of the Arm-bone, and from the hinder Proceſs of the *ulna*; from whence it paſſeth on obliquely, being without membranous, and within fleſhy, and is inſerted into the middle of the *radius*.

2.

Note that though for orders ſake we have deſcribed the Muſcles of the *radius* next to thoſe of the *ulna*; yet when one would ſhew them in Diſſection, the Muſcles of the Fingers, Thumb and Wriſt are firſt to be raiſed, and then theſe of the *radius* after thoſe are taken away.

CHAP. XXIV.

Of the Muſcles of the Wriſt.

THE *Carpus* or Wriſt has three Motions: It is either bended, extended, or moved ſideways. For its flexion and extension it has proper Muſcles: but as for its motion ſideways, that is not performed by any proper Muſcles, but as one, or two of the ſame ſide (of the benders and extenders) act; for then is it moved upward or downward accordingly.

It is bended by two Muſcles in the inſide. The firſt is *cubitus internus*: this ariſeth by both a fleſhy and nervous beginning from the inner knob of the Shoulder-bone; then paſſing fleſhy the length of the *ulna* or *cubitus*, it doth end by a Tendon, partly nervous, and partly fleſhy, in the fifth,

Benders.

I.

2. fifth, some say the fourth Bone of the first rank in the Wrist. The second is *Radius internus*: this arising from the same place, and passing along the *radius*, is inserted into that Bone of the back of the Hand which sustains the fore-Finger.

Extenders. Two External Muscles stretch out the *Carpus*.

1. The first is *radius externus*, or *bicornis*: this ariseth from the sharp edge of the outer knob of the Shoulder-bone in the upper part of it, by a broad beginning: then becoming fleshy, it passeth to the middle of the *radius*, where it becometh a strong Tendon, which presently is divided into two almost round Tendons. Both these pass a little asunder by the *radius* under the Ligament, whereof one is inserted into that Bone of the back of the Hand which stayeth the fore-Finger, and the other into the Bone which stayeth the middle Finger.
2. The second is *cubitus externus*: this hath its beginning from the root of the external knob of the Shoulder-bone: it passes along the *ulna*, and when it is come to the Wrist, it endeth in a strong round Tendon, which is inserted into the upper part of that Bone which stayeth the little Finger, not far from the Wrist.

CHAP. XXV.

Of the Muscles of the Palm of the Hand.

THIS is thought to have two Muscles. The first is *palmaris*, which ariseth from the inner knob of the Shoulder-bone, round and nervous, but presently becoming fleshy it continues its course along the Cubit, under all the other Muscles, till at length it turns into a round Tendon, which passing over the *ligamentum annulare* of the Wrist, is afterwards dilated into a broad nervous membrane, which cleaveth firmly to the skin of the Palm of the Hand, for firm apprehension or griping, and quickness in feeling, and endeth at the first Joints of the Fingers.

The Palm
but two
muscles.
I.

The second is *caro quædam quadrata*, or a four-square fleshy substance: this springeth from the *membrana carnosæ* under *mons lunæ*, where the eighth Bone of the Wrist is placed. From thence it is carried under the *musculus palmaris*, to the middle of the Palm of the Hand, and is inserted into the outside of that Tendon which moveth the little Finger outwards. This representeth two or three Muscles, and serveth for the hollowing of the Palm of the Hand, to form *Diogenes* his Cup by, bringing the fleshy eminence under the little Finger, unto the *Tenar*.

2.

C H A P. XXVI.

Of the Muscles of the four Fingers.

THE Fingers are bended, extended, and moved laterally. But seeing the motion of the Thumb differs very much from that of the other four Fingers, we shall describe its Muscles in the next Chapter, seeing they are altogether distinct from those of the Fingers.

Benders of
the four
fingers.

1. The Fingers are bended by three Muscles. The first is called *sublimis*, or *perforatus*. This springeth from the inside of the inner knob of the Shoulder-bone; and about the Wrist it produceth four Tendons, which end in the second joint of the Fingers. Near their end they are cleft, to give way to the Tendons of the *profundus* passing through. The second is named *profundus*. This ariseth from the upper parts of the *ulna* and *radius*, a little below the Joint of the Elbow, and being separated at the Wrist into four Tendons, these run through the Clefts of the Tendons of the *sublimis*, and are implanted into the third Joynt of the Fingers. The third sort of Muscles are called *Lumbricales*. These are very small, and arise from the Tendons of the *musculus profundus*, and end in a round Tendon in the first Joint of the Fingers, being confounded with the Tendons of those Muscles that move the Fingers laterally; yea sometimes they proceed further along with them, by the sides of the Fingers, to the third Joynt, and assist their lateral Motion.
- 2.
- 3.

The

The Fingers are extended by three Muscles, *Extenders*, whereof one is *common* to all the four Fingers, and two *proper* to two particular. The *common* is *extensor magnus*. This arising from the outer knob of the Shoulder-bone, about the Wrist is divided into four Tendons, which are inserted into the second and third Joynts of the Fingers; some make two of this. The *proper* are two. The first is called *indicator*, because it belongeth to the fore-Finger. It ariseth from the outward and middle part of the *ulna*, and by a double Tendon it endeth in the second Joynt of the fore-Finger: but one of the Tendons becometh one with the Tendon of the *extensor magnus*. The second is named *auricularis*, because it belongeth to the little Finger. It ariseth from the upper part of the *radius*, and marching between the *ulna* and the *radius*, it is inserted by a double Tendon into the outside of the little Finger.

The Fingers are laterally moved two manner of ways: for either they are brought to the Thumb, or they are carried from it. These Motions are performed by eight Muscles, called *interossei*, because they are placed between the Bones of the *metacarpium*. They are fleshy and round, and spring from the Bones of the *metacarpium*, to which they adhere, passing streight along them. When they are come to the Roots of the Fingers, they pass into Tendons which cleave to the sides of the Fingers, and end in the last Joynt of the Fingers near the root of the Nails. When the Tendons of the *Lumbricales* joyn with these, they may be reckon'd amongst the Movers of the Fingers laterally, and then there will be twelve in all, the *Lumbricales* being four, and these *interossei* eight.

*Abducing
muscles,
two.*

Besides these Muscles, the fore-Finger and the little Finger have each one *proper* Muscle. That of the fore-Finger may either be called *abducens* in respect of the middle Finger from which it draws it ; or *adducens*, in respect of the Thumb towards which it draws it. It springs from the inside of the first Joint of the Thumb, and ends in the Bones of the fore-Finger, which it pulls towards the Thumb. That of the little Finger is called *Abductor* (by some *hypotenar*) and springs from the third and fourth bone (of the second rank) of the Wrist ; whence proceeding along the palm of the hand, it is implanted by a small nervous tendon into the outside of the first joint of the little Finger, which it draws outwards from the rest.

CHAP. XXVII.

Of the Muscles of the Thumb.

Extenders.

1.

THE Thumb is extended by two Muscles. The first is that which is called *longior*. This ariseth fleshy from the outer and upper side of the *ulna*, near the membranous ligament which tyeth together the *ulna* and *radius*. From thence it is carried obliquely upon the *radius*, and before it come to its *appendix*, turneth into a round Tendon ; which passing under the annular ligament of the Wrist, marcheth along that side of the Thumb, which is next to the fore-Finger, and is inserted into its third bone. The second is named *brevior*. This ariseth from the same

2.

same origine with the other, and passeth obliquely above the *radius*. By one Tendon it is implanted into the root of the first joint of the Thumb; the other becoming membranous, cleaveth fast to its second and third bone.

It is bended also by two Muscles; one of which springing from the upper part of the *radius*, is implanted into the first and second joint of the Thumb; the other being less, proceeds from the bone of the *carpus*, lying under the other, and reacheth to the middle of the Thumb. These two *Spigelius, de hum. corp. fabric. l. 4. c. 19.* divides into five Muscles, which together with the *abducens* of the Thumb, make the *monticulus lunæ*. Benders.
Monticulus lunæ.

It is moved laterally by two Muscles. The first is called *thenar* or *abducens*. This springeth from the inner part of that bone of the Wrist, which stayeth the Thumb, by a nervous beginning: then becoming fleshy, it is inserted into the first joint of the Thumb by a membranous Tendon, and draweth it from the fore-finger. Some make three of it. The second is *antithenar*, or *adducens*, which lyeth in the space between the Thumb and fore-finger. This doth arise from the outside of that bone of the *metacarpium* which sustaineth the first finger; and being fleshy is inserted into the whole inner side of the first joint of the Thumb, and sendeth a membranous Tendon to the second. This draweth the Thumb to the fore-finger. Some describe a second arising from the inner side of the bone of the Wrist that sustaineth the Thumb, and ending in its second joint. Movers laterally.
I.
2.

CHAP. XXVIII.

*Of the Muscles of the Thigh.**Benders
forward.*

1.

THE Thigh has four manner of motions: It is either bended (and that forwards, or backwards) or drawn inward, or outward, or moved round. It is bended forward by three Muscles. The first is called *psaos*, or *lumbaris*: this lyeth in the inner part of the *abdomen*, upon the *vertebra* of the loins, &c. It ariseth fleshy from the transverse processes of the two lowermost spondyls of the thorax, and two or three uppermost of the Loins, from whence descending by the inside of *os ilium*, it is inserted by a round and strong Tendon into the lesser *rotator*. The second is *iliacus internus*: This springeth with a slender and fleshy beginning from the inside of *os ilium*, and being joyned to the *psaos* by its Tendon, it endeth before between the greater and lesser *rotator*. The third is *pectineus*: this arising broad and carnos from the upper part of the *os pubis*, is implanted a little below the neck of the Thigh-bone, on the inside, and draweth the Thigh upward and inward, and so helps us to lay one Thigh over the other when we sit cross-leg'd.

*Benders
backward.*

1.

It is bended backward or extended by the three *glutæi*, which make up the Buttocks, and serve to go backward withal. The first is the outermost and the greatest, called *glutæus major*. It springeth very carnos from the *coccyx*, from the spine of *os sacrum*, and from all the circumference of the

the

the spine of *os ilium*, and is inserted by a strong Tendon four inches below the great *rotator*. The second is the middlemost, called *glutæus medius*: This springeth from the foreside of the spine of *os ilium* a little lower than the former, and is inserted into the outer and upper side of the great *rotator*. The third is the lowermost, called *glutæus minor*: This springeth a little lower, from the outer or back part of *os ilium*, lying wholly under the second, and is implanted into the upper and inner part of the great *rotator*.

2.

3.

It is drawn to the inside by the *musculus triceps*: *Drawers to the inside.* this is the thickest of all the Muscles of the Body, and might more justly be called *quadriceps*, seeing it has four beginnings; but they that imposed the name of *triceps*, made a particular Muscle of the fourth Head, and called it *pectineus*, or *lividus*. The first head doth proceed nervous from the upper part of the share-bone, and is inserted into the rough line of the thigh-bone. The second springing from the lower side of the same bone, being lesser, is inserted a little higher up into the said line. The third arising from the whole lower part of the *coxendix*, is inserted a little under the lesser *rotator*. The fourth springing from the apex or tip of the *coxendix* is implanted into the inner and lower tubercle of the Thigh by a round Tendon, which is joyned with the slender Tendon of the first part of this Muscle.

It is turned towards the outside by four small Muscles called *quadrigemini*. They are placed above the articulation of the thigh one by another. The first is called from its situation *Iliacus externus*, and from its figure *pyriformis*; it is longer than the rest, and ariseth from the lower and outer

Turners to. wards the outside.

I.

2. part of the *os sacrum*. The second ariseth from the knob of *os ischium*. The third ariseth from the same part. These three are inserted into the hollowness of the great *rotator*. The fourth is called
4. *quadrigenus quadratus*, more fleshy and broad than the rest: it lyeth two inches distant from the third, and ariseth from the inner part of the knob of the *ischium*, and is implanted into the outward part of the great *rotator*.

Turners
about ob-
liquely.

1. It is turned about obliquely by two Muscles called *obturatores*. The first is *obturator internus*, this turneth it outward. It ariseth from the inner circumference of the hole that is between the *ischium* and *os pubis*, and is inserted into the cavity of the great *rotator*. The second is *obturator externus*: this ariseth from the external circumference of the said hole, and turning about the neck of the thigh-bone, as about a pulley, it endeth in the cavity of the great *rotator*, under the fourth *quadrigenus*, and turneth the Thigh inward.
- 2.

Note, that though for orders sake we have describ'd the Muscles of the Thigh before those of the Leg, yet the Dissector cannot so easily nor conveniently raise and shew them, till those of the Leg are first raised and removed.

CH A P. XXIX.

Of the Muscles of the Tibia or Leg.

THE Leg is either bended, extended, or moved obliquely. There are five that bend it. Benders.
 The first is *longissimus* or *fascialis*. This ariseth 1.
 from the inner knob of *os Ilium*, and descends
 outermost just under the skin on the inside of the
 Thigh, being slender, and near the Knee it ends
 in a Tendon, which is inserted under the Knee,
 into the fore and inner side of the *tibia*. The se-
 cond is called *gracilis*, and springeth with a ner-
 vous and broad beginning at the joynting of the
ossa pubis; from whence it runs down the inside of
 the Thigh, and is implanted by a round Tendon
 into the inner side of the *tibia*, near the insertion
 of the first, but a little lower. The third is named 2.
seminervosus: This beginneth nervous and slender
 at the knob of the *ischium*, and descending
 obliquely to the back and inner part of the
 Thigh endeth in the inner side of the *tibia*,
 towards the backside, about the middle of its
 length. The fourth is *semimembranosus*: it pro-
 ceedeth from the same knob, partly nervous, and
 partly membranous; and marcheth by a broader
 Tendon than the third to the hinder part of the
tibia. The fifth is *biceps*: this ariseth from the same
 knob of the *ischium*; and being carried on the
 outside of the Thigh, about its middle it becometh
 fleshy, as if it begun there with a second head;
 from whence descending it is inserted by a notable
3.
4.
5.
 Tendon

Tendon into the outer side of the upper process of the *fibula*.

- Extenders.* The Leg is extended by five Muscles. The first
1. is *membranosus*: this proceeding fleshy from the upper part of the spine of *os ilium*, on the outside near the great process of the Thigh-bone it turns into a broad membrane, wherefore it is called *fascia lata*, for it covereth almost all the Muscles of the Thigh and *tibia*, and at last is inserted a little below the Knee, into the outer and
 2. fore-side of the *tibia* and *fibula*. The second is *longus*: this ariseth from the upper and fore-part of the appendix of *os ilium*, and passing by the inside of the Thigh obliquely, it endeth in the inside of the Leg a little below the Knee. It extends the Leg, drawing it inwards; and because it helps to lay one Leg upon the other when we go to sit cross-leg'd, some call it *sutorius*, the
 3. Shoemakers or Tailors Muscle. The third is *rectus*: this springing from the lower brim of the *os ilium*, and passing with a carnos and round belly streight down the Thigh before, when it is come to the *patella*, it ends in a broad and strong Tendon, by which it adheres close to the *patella*, as if it would end in it; but it passes further, and is inserted into the fore-side of the *tibia* a little below
 4. the Knee. The fourth is *vastus externus*: this springeth from the root of the greater *trochanter*, and endeth a little below the *patella*, near the same place with the former. The fifth is called
 5. *vastus internus*: this ariseth from the root of the lesser *trochanter*, and endeth a little below the *patella* with the other. The *vastus externus* descends on the outside of the *rectus*, and the *internus* on the inside thereof, whence they have their name.

To

To these some add a sixth Muscle called *crureus*, which springeth from the fore-part of the Thigh-bone, between the two *trochanters*, and endeth in the same place with the former.

6.

Note that these four last Muscles being joined together about the Knee, make one common broad and strong Tendon, by which they involve the *patella* or Knee-pan, and which being inserted into the *Tibia*, ties it and the Thigh-bone together like a strong ligament. Note also that the Muscles which extend the Leg are stronger than those which draw it in, that the weight of the Body may be the more firmly upholden when we stand.

There is also a single Muscle called *popliteus*, or *subpopliteus*, which moveth the Leg obliquely: this lyeth in the hollow of the ham, and springeth from the lower and outer knob of the Thigh-bone, and is carried obliquely to the hinder and inner root of the upper appendix of the *sibia*. *Mover obliquely.*

CHAP. XXX.

*Of the Muscles of the Tarsus or Instep.**Benders.*

- T**HE Foot is bended, extended and moved sideways, according to the motion of the Instep, which first is bended when it is drawn upwards. To perform this motion it hath two Muscles. The first is *tibialis anticus*: this ariseth from the upper appendices of the *tibia* and *fibula*, and cleaving unto the whole *os tibiae*, about the middle of it, it becometh narrower, and turneth by degrees into a Tendon, which passing under the annular ligament of the Instep, that springs from the lower appendices of the *tibia* and *fibula*, is commonly divided into two; whereof the one is inserted into the first of those bones which are called *innominata*, and the other into that bone of the *metatarsus* that is set before the great Toe. If the Tendon continue one, then it is implanted into the inner side of this last Bone. The second is *peronæus anticus*: this ariseth from the outer and upper part of the *fibula*, and being carried through the chink of the outer ankle, it is inserted into that bone of the *Metatarsus* which sustaineth the little Toe. It descends all along by the outside of the foregoing Muscle, and hath sometimes two Tendons.

The

Extenders.

1.

2.

3.

The foot is extended when it is drawn backwards. To perform this motion it hath three Muscles. The first is *gemellus externus*, or *gastrocnemius externus*: this Muscle hath two heads, the first of which arises under the ham, from the inner part of the end of the thigh-bone, fleshy and broad. It marcheth down by the back and inner part of the *tibia*, and when it is come to the middle of it, it becometh tendinous. The other head likewise ariseth under the ham, but from the outer part of the end of the Thigh-bone, and passing down by the outward and back part of the Leg, becometh tendinous a little above the former, and joyning with it they both grow into one strong, broad, and sinewy Tendon, which is inserted into the Heel. This is the Muscle that maketh up the greatest part of the Calf of the Leg. The second is *gemellus internus*, or *gastrocnemius internus*, or *soleus*. This lyeth under the former, and is of a livid colour. It springeth from the hinder *appendix* of the *fibula* by a strong nervous beginning, and growing pretty bulky it continueth so till it hath passed the middle of the *tibia*, when it becometh narrower, and tendinous; and a little above the Heel it is so united to the Tendon of the former *gemellus*, that both seem to be but one, and is inserted with it into the Heel. The third is *plantaris*. This springeth from the outer part of the end of the Thigh-bone in the ham, being very small but carnous. It descends but a little way before it ends in a very

very long and slender Tendon, which joyning very closely with those of the two former is fastened to the Heel, but reaches as far as the middle of the soal of the Foot; *Spigelius* says, as far as the Toes, and is inserted into each of them, imitating the *palmaris* of the hand. The three Tendons of these three Muscles thus uniting make one most strong and thick Tendon, usually called *the great cord*; and this being implanted into the Heel makes a wound there so very dangerous.

Movers
sideways.

I.

The Foot is moved sideways by two. The first is *tibialis posticus*, *adducens pedem*, or *Nauticus*, because Sailors use it much when they go up by the Ropes. It springeth both from the *tibia* and *fibula*, and from the Ligament which tyeth them together, whence descending among the hinder Muscles, near to the inner Ankle it becometh tendinous: then passing by it, it goeth to the soal of the Foot, and is inserted into the lower part of that Bone of the *tarsus* which is next to the *cubiforme*. This moveth the Foot inwards.

2.

The second is *peronæus* or *fibulæus posticus*: this ariseth from the upper and hinder part of the *fibula* or *perone*, by a nervous and strong beginning; and cleaving to the outside of the *fibula*, it passeth down round and fleshy: the outer part is of a livid colour, but the inner of a red. When it is come to the middle of the *fibula* it becometh tendinous, and descends with the *peronæus anticus* by the fissure of the outer Ankle, but joins not with it, for it goes under the soal of the Foot, and is inserted into the root of the
grea-

greater *os cuneiforme* that is seated before the great Toe. Sometimes, though seldom, there is another Muscle, called *peronæus tertius*, which being very slender accompanies the *posticus* in its whole progress, and is inserted into the same place, assisting its Action.

CHAP. XXXI.

Of the Muscles of the Toes.

THE great Toe is moved by its *proper* Muscles, as the Thumb of the Hand was: but the other four, by *common*; which we will first describe. They are extended by two. The first is *tensor longus*. This ariseth by a nervous and sharp beginning from the upper and fore *appendix* of the *tibia*, and presently becoming carious, it goeth streight down, and being come to the Instep it is divided into four Tendons, which passing under the annular Ligament, go each to one of the lesser Toes, and are inserted into their second and third joint on the upper side. The second is *tensor brevis*. This lyeth under the former, having its beginning from the transverse or annular Ligament, fleshy and broad; and by its four Tendons is inserted into the first joynts of the four Toes.

Extenders.

I.

2.

The

Tenders.

1.

The benders of the Toes are in like manner two, and four *Lumbricales*. The first is *flexor longus*, or *perforans*: it lyeth under the *gemellus internus*, and ariseth from the upper and hinder part of the *tibia* by a long and fleshy beginning; and passing down lengthways of the *Tibia*, (unto which it cleaveth) when it is past the middle of it, it becometh tendinous: then running by the inner Ankle, under the Ligament of the *tibia* and Heel, to the soal of the Foot, it is there divided into four Tendons, which passing through the holes of the *flexor brevis*, are inserted into the third and last joynt of the four Toes.

2.

The second is *flexor brevis*, or *perforatus*: this springeth from the lower and inner part of the Heel-Bone, and when it hath passed the middle of the Foot, it is parted into four round Tendons, which are inserted into the second joint of the four Toes, being perforated to give way to the Tendons of the former Muscle to pass to the third joint.

Four Lumbricales.

They are also bended by four *Lumbricales*, which agree altogether with the *Lumbricales* of the hand both in their use, figure and rise. These spring from the Tendons of the two former small and round, and are inserted by a small Tendon into the side of the first joint, which they help to bend. The fleshy substance, which riseth with two sharp beginnings from the fore part of the lower side of the Heel-bone, and reacheth to the rise of these Muscles, seemeth much to further their Action, and to afford them their carnos Substance.

The

The Toes are moved obliquely by the *Interossei*, ^{Movers obliquely.} which are so called, because they are placed between the bones of the *Metatarsus*. They are ten in number, whereas there are but eight in the Hand, because the *Metatarsus* hath one bone more than the *Metacarpus*. Each of them doth spring from the under side of that bone where it is placed; and all marching according to the length of the bone fleshy, they are inserted the outer into the first joint, the inner into the second of the Toes, by short and somewhat broad Tendons. If the inner be contracted, the Toe is moved inwards; but if the outer be moved, the Toe is carried from the rest outwards. But if they both act together, then are the Toes extended. In the four distances between the bones, there are eight such Muscles; at the outside of the great Toe one, and another at the outside of the little Toe. But besides *it*, the little Toe hath a proper *Abductor* to move it outwards, which arising from the Heel passes on the outside of the fifth bone of the *Metatarsus*, and is inserted into the outside of its first joint.

The great Toe hath five peculiar Muscles. ^{Extender of the great toe.} The first is *Extensor*: this springeth by a fleshy beginning from the outside of the *Tibia*, where it parteth from the *Fibula*. It cleaveth fast to the Ligament which ties the *Tibia* to the *Fibula*, and marching along the upper part of the Foot, it is inserted into the whole upper part of the great Toe.

The second is *Flexor*: this springeth from the ^{Bender.} upper and back part of the *Fibula*, and descending by the side of the *Flexor longus* to the inner Ankle, it there becometh tendinous, and is inserted

serted into the third or last bone of the great Toe, by one strong Tendon. But sometimes it is divided into two Tendons, whereof one is inserted as abovesaid, and the other into the second Toe: and when this happens, the *Flexor longus* sends but three Tendons to the three last Toes, and none to the second.

*Movers
Side-ways.*

The third is *Abducens pollicem*, which draweth the great Toe from the rest, to the inner part of the Foot. It springeth nervous from the Ligament which tieth together the Heel-bone and the *Talus*, (or according to some from the inner side of the Heel it self) and running forwards on the inside of the Foot, it is inserted by a round Tendon into the outside of the first joint of the great Toe.

The fourth is *Adducens pollicem major*. This springeth from the Ligament of that bone of the *Metatarsus* that sustains the little Toe and the next to it, and proceeding obliquely over the other bones it is implanted into the inner side of the first joint of the great Toe.

The fifth and last is *Adducens pollicem minor* (otherwise called *Transversalis*.) This ariseth from the Ligament of the little Toe that tieth its first joint, and passing cross the first bones of the Toes it ends in the inside of the first bone of the great Toe. Some think this serves only to tie together the first bones of the Toes (like a Ligament:) But *Casseri* (who first found it out) says it draws the great Toe to the little one, and so makes the Foot hollow, grasping the ground as it were, when we go in stony and uneven places, to fix the Foot more firmly.

The end of the fifth Book.

The Sixth Book.

OF THE B O N E S.

CHAP. I.

Of the Nature of a Bone.

A Bone is called in Greek *ὀστέον*, from *ὀστος* to *Its name.*
stand; for according to *Hippocrates*, *τὸ*
ὀστέον *σύναν, ὃ ἐξ ὀστέου, ὃ ἐκ δὲ πνεύματος,*

it affords stability, streightness and form to the Body.

It may be defined to be a *similar part, most dry* *Definition.*
and cold, inflexible, void of sense, affording stabili-
ment and form to the whole Body.

Bones have been commonly taught to be made *Matter.*
of the more crass, tartareous or earthy part of
the Seed, in the Womb, and that they are nour-
ished with the like particles of the Bloud, and
moisten'd with their contained Marrow. And I
see no reason to recede from this doctrine, unless
one would commence *litum de nomine*, brangle

about a term : for though Women have no true Seed, and the Man's being only an active principle of generation affords nothing of matter to the parts of the *Fetus*, but only impregnates the *Ovum*, (as was shewn in Book 1.) yet if we will but grant the name of Seed to the humour in the *Ovum*, (which we may do without absurdity) we may continue the old manner of speaking. Now though they are continually nourished, yet towards Manhood, by the encreased heat of the Body, the primigeneal moisture is so lessened, that the Bones through their hardness are not apt to be any longer extended; and so Men cease to grow any higher of stature.

Vessels.

Their nourishment is brought to them by the *Arteries*, and what is not fit for their use returns back by the *Veins*. Several of them, as the Shoulder and Thigh-bones, have apparent holes for the entrance of the vessels into their Marrow: and such as have no Marrow and so want such holes, they are commonly of a more spongie or fungous substance, into which no doubt some nutritive particles of the Bloud pass from the Arteries, though their branchings therein are not so apparent. There are no Nerves that are inserted into them (except into the Teeth) but these only run through the Membrane or *Periosteum* that invests them.

*Efficient
and formal
causes.*

The efficient cause of the Bones is the same vivifick spirit or plastick power seated in the *Ovum*, that forms all the other parts of the Body; *Galen* call it *Facultas formativa*, the ossifick faculty: some think this same spirit might be called the *essential form* of the Bones; though commonly that is said to be their cold and dry temperature;

rature; as their *accidental form* is their figure, which is commonly either round or flat. But these are too dry notions to be insisted on in this place.

Their substance is whitish and hard, (in some *Substance*. Bones, and at some ages, more, and in others less) not altogether dry in living persons, but bedewed with a fat and unctuous moisture, which the more it abounds, the Bones are the tougher and less apt to break; and when they are broken, they are the apter to grow together again with a *Callus*, which such viscous juice contributes very much to. And it is only by a *Callus* that any Bone is joined after fracture; for a Bone being of the number of those parts that are called *spermatick*, can never be generated anew.

CHAP. II.

Of the natural affections of Bones.

THE Affections of Bones are either *common* to all, or *proper* to some only.

The *common* are seven. For first, a Bone must *Common* be hard, the more firmly to sustain the Body. *affections*. Secondly, of a whitish colour, because it is a *spermatick* part. Thirdly, destitute of feeling, for avoiding of pain in motion. Fourthly, it must be either hollow to contain Marrow in its Cavity for moistening of it; or spongy and porous, that some nutritive particles of the Blood may pass through its very substance. Fifthly, its ends

must be covered with a Cartilage, and that bedewed with an unctuous humour, to procure an easie motion. Sixthly, it must be covered with a Membrane, to preserve it from cariosity; except the four Bones of the Ear, and the parts of the Teeth above the Gums. Seventhly, it must be equal. Wherefore the *Callus* wherewith a broken Bone is united, and nodes in the Pox, are not natural affections.

These tokens that follow, shew a Bone to be preternaturally affected: First, if it be soft; because that must cause the Member to be too flexible. Secondly, if it be too dry; for then it is distempered. Thirdly, if it be black; for then it is carious. Fourthly, if its figure be altered; for then it must hinder the action of the part.

Proper.

The *proper* affections are four: The first is a *Cavity*; and it is twofold: for it is either deep, as in the Hip-bone, and is called *Cotyle*; or shallow, as in the Knee, and is called *Glene*. The second is a *Protuberance*, of which there be two kinds: for it is either a continued part of the Bone jetting manifestly above its plain superficies, for the more commodious insertion of the Muscles, &c. and is called *Apophysis*, a Process; or else it is like an additional Bone growing to another by simple and immediate contiguity, (and generally softer and more porous than it) and is called *Epiphysis*, an Appendage. If the Protuberance of the Bone be round, it is called its *Caput*; under which is the *Cervix*, as in the upper end of the Thigh-bone: If it be flat, it is called *Condylus*: If pointed, *Corone*. Other Protuberances are named from the similitude they have to other things; as *Spyloides*, *Coracoides*, &c. The third
is

is *Inequality*: this is seen in the outside of the *Occiput* for the insertion of the Muscles. The fourth is *Smoothness*, as in the outside of the rest of the Skull.

CHAP. III.

Of the differences of the joining of Bones together.

THEY are coupled together either by *Articulation* or jointing; or else by *Symphysis* or growing together.

Articulation is either for *manifest*, or *obscure Articulation*. The jointings which serve for *manifest* motion are three. First, *Enarthrosis*, which is when a large head of a Bone is received into a deep Cavity, as the Thigh-bone into the Hip-bone. Secondly, *Arthrodia*, which is when the Cavity which receiveth is shallow, and the head of the Bone which is received, flattish: such is the articulation of the lower Jaw with the Temple-bone. The third is *Ginglymos*; when the same Bone receiveth, and is received. This falleth out three manner of ways. First, when the Bone is received by another, and receiveth the same; this is seen in the articulation of the Shoulder-bone with the *Ulna*. Secondly, when a Bone receiveth one Bone, and is received by another: this may be seen in the Spondyls or *Vertebra* of the Back, where the middle Bone receiveth the upper, and is received by the lower. The third

is, when the process of the Bone being long and round, is inserted into another upper Bone, and so is turned in the Cavity like an Axle-tree in a Wheel; so is the second *vertebra* of the Neck jointed with the first.

Articulation for *obscure* motion is called *Synarthrosis*; and such is the jointing of the Ribs with the *Vertebra*, of the Bones of the *Carpus* and *Metacarpus*, and of the *Talus* with the Heel-bone.

Symphy-
sis.

Bones grow together either without some middle heterogeneous substance, or with it. Without some middle substance they are joined three manner of ways. First, by a simple line, as the Bones of the upper Jaw and Nose: this is called *Harmonia*. Secondly, by a suture, as the Bones of the Skull. Thirdly, when one Bone is fastened in another, as a nail in wood; and so are the Teeth fastened in the Jaw-bone: this is called *Gomphosis*. If Bones grow together by a middle substance, it is either by a Cartilage, as the Share-bones are joined; which union is called *Synchondrosis*: or by a Ligament, and so the Thigh is joined with the Hip-bone; this is called *Syneurosis*, or more properly, according to *Spigelius*, *Syndesmosis*: or last of all by Flesh, and so is the Bone of the Tongue by its Muscles to the adjacent parts; this is termed *Syssarcosis*.

Spigelius reckons two other heterogeneous middle substances by which Bones are united; one when they are joined by a Tendon, as the Kneepan to the Thigh-bone and *Tibia*, which union he calls *Syntenosis*; the other by a Membrane, as in Infants the Bones of the *Sinciput* with the *Ossis frontis*; and this he calls *Synymensis*.

CHAP. IV.

Of the Sutures of the Head.

THE Bones of the whole Body belong to these four parts of it; the Head (and Neck) the Breast, the lower Belly, and the Limbs.

The *Head* is that part which is above the *vertebra* of the Neck: of it there are two parts, the Skull and the Face. The *Skull* is that bony substance which containeth the Brain, and is decked with hair.

In the description of the Bones of the Head these two things are to be noted; the *Sutures*, and the *number* of the Bones. The *Sutures* are either *proper*, or *common*.

The *proper* are those which join the Bones of the Skull one with another; and they are either *true Sutures*, or (*mendosa*) *counterfeit*.

The *true* are those which represent two Saws joined together by their Teeth; and these are three in number: the first is *Coronalis*, which is seated in the fore part, and passeth from one Temple to the other transversly, joining the *Os frontis* to the *Synciput*. The second is *Lambdoides*, opposite to this, resembling the Greek letter Λ . This beginning at the basis of the *Occiput* ascends obliquely to either Ear, and joins the Bone of the *Occiput* to the Bones of the *Synciput* and Temples. The third is *Sagittalis*, which beginning at the top of the *Lambdoides* comes streight forward by the Crown to the middle of the *Coronalis*,
and

Sutures

proper or

common.

Proper su-

tures true

or counter-

feit.

Three true.

and in Children for some years (sometimes in the adult) it runs to the top of the Nose, dividing the bone of the Forehead into two.

Two counterfeits.

The *counterfeit* or *mendosa* resemble a line only, and might more properly be called *Harmonia* than Sutures. They are two in number. The first passing from the root of the *Processus mammillaris* upwards with a circular duct, circumscribes the Temple-bone on each side of the Head, descending down again to the basis of the Ear : this joins the Bones of the *Synciput*, *Occiput* and *Sphenoides* with the Temple-bones, these lying upon those like the Scales upon Fish, whence these Sutures are called *Squamosa*. The second runs from the top of this squamous conjunction obliquely downwards towards the orbit of the Eye, to the beginning of the first common Suture, and joins this Bone above with the Bones of the *Synciput*, below with the Bone of the Forehead.

Common sutures.

The *common* Sutures are those which belong to the Skull, the wedge-like Bone, and the upper Jaw. The most remarkable are these : first, *Frontalis*, by which the outer process of the *Os frontis* is joined with the first Bone of the upper Jaw. The second is *Cuneiformis*, by which the wedge-like Bone is joined with the first Bone of the upper Jaw. The third is *Cribrosa* : this is common to the wedge-like Bone, and the *Septum* or partition of the Nose.

The uses of the sutures.

The Sutures have three uses. The first is to help to stay the Brain from tottering, and its parts from being misplaced in violent motions, by permitting some Fibres to pass through from the *Dura mater* to the *Pericranium*, by which the said *Mater* and the Brain invested in it are suspended
as

as it were. The second is to permit the steams and fumes in the Brain to evaporate. And the third, to hinder the fissures that happen in the Skull from knocks or falls, &c. from extending any farther than through one Bone, for they generally stop at the next Suture.

CHAP. V.

Of the proper Bones of the Skull.

THESE are in number six, one of the Forehead, another of the *Occiput*, two of the Crown, and two of the Temples.

First, *Os frontis*, the Forehead-bone. It is *Os frontis*, bounded by the Coronal and first common Suture, before; and in the sides by the temporal Bones. It is but one in those of ripe age, but double in Children, being divided by a Suture passing from the Coronal to the Nose.

Betwixt the *Lamina* of this Bone in the upper part of the Eye-brows at the top of the Nose, there is a large Cavity, (often two) from whence two holes pass to the Nostrils. The outer *Lamina* that constitutes this Cavity, makes the upper plane part of the orbit of the Eye; but the inner, on each side above the Eyes forms a buncy protuberance uneven with many jettings out like little Hills. The Cavity is invested with a very thin greenish Membrane, and contains a clammy humour. What its use may be is hard to say; some think it gives an Echo to the Voice, making
it

it more sonorous; others that it receiveth the odoriferous air drawn in by the Nose, to stay it awhile before it be sent to the Brain. It hath two holes in the middle part of the Eye-brow, which go to the orbit of the Eye, by which the first branch of the Nerve of the fifth conjugation of the Brain goes to the Muscle of the Fore-head, &c. It hath also four processes; the greater two are seated at the greater corner of the Eye, but the lesser two at the lesser, making the upper part of the orbit.

The bones
of the Syn-
ciput.

The Bones of the Crown are in number two. Before, they are joined with the Bone of the Fore-head, by the Coronal suture; behind, with the *Os occipitis* by the Suture *Lambdoides*; and on each side to the Temple-bones, by the *Sutura squamosa*. They are joined to one another in the middle of the Crown by the sagittal Suture. On the outside they are smooth, but on the inside uneven, for they have a great many furrows running along them for the passage of the Veins of the *Dura mater*. Their substance is thinner and more rare even in the adult than that of the other Bones (for the better exhalation of vapours) but in Infants that abound with much humidity, they are membranous and soft, hardening by degrees.

The tem-
ple-bones.

Under these on each side are the Bones of the Temples. They are joined in their upper part to the outside of the Bones of the Crown by the *Sutura squamosa*; before, to the first Bone of the upper Jaw, by its first process; behind, to the *Os occipitis*, by a counterfeit Suture. These Bones are even and thin in the upper part, like a Skale; but below thick, hard and unequal or craggy; wherefore they are called *Petrosa*.

They

They have each two *Sinns* ; the *outer* greater, *Their Si-*
lined with a Cartilage, betwixt the *Meatus audi-*
torius and the process of *Os jugale*, that receives
the longer head of the lower Jaw ; the *inner* less,
common to the Bone of the *Occiput*, placed on the
hinder side of the said process.

By these *Sinns* there stands a slender, sharp and *Os styloi-*
longish *Appendix*, from its shape called *Stylofor-*
mis, which in Infants is cartilaginous, but in the
adult becomes bony.

Besides this *Appendix* they have three other
Processes, two *external* and one *internal*.

The *first external* is blunt, thick and short, a *Processus*
little hollow within, and because it somewhat re-
sembles a Cow's Pap is called *Mammillaris*. *mammil-*
lars.

The *second* is carried forward from the *Meatus*
of the Ear, and is joined with the Bone of the up-
per Jaw, both of them framing the *Os jugale*, of
which in the next Chapter.

The *third*, that is *internal*, is pretty long, jet-
ting out to the inner basis of the Skull, *within*
which it has two holes, through one of which an
Artery, and through the other the auditory
Nerve pass to the inner Cavities of the Ear, that
are excavated in this Bone, namely the *Tympanum*,
Labyrinthus and *Cochlea* ; and *without* the Skull it
hath three holes ; the first of which is the *Meatus*
auditorius ; the second is narrow, short and ob-
lique, near to the first, by which the Jugular vein
enters the inner Cavities ; the third is seated be-
twixt the *Processus mammillaris* and the *Styloides*
appendix, and ends into that passage that goes
from the Ear to the Mouth.

As to the four little Bones that are contained
in its Cavities, *viz.* *Incus*, *Malleus*, *Stapes*, and

Os

*Os occi-
pitis.*

Os orbiculare, we have spoken of them before in Book 3. Chap. 23.

The *Os occipitis*, that makes the hinder and lower part of the Head, is five-corner'd, by two of which corners it is joined in its upper part to the Bones of the *Synceput* by the *Lambdoides* Suture, by two other in its foresides to the Temple-bones by a counterfeit Suture, and by its fifth corner to the *Os cuneiforme*, (according to *Spigelius*.) It is but one in the adult, but it consists of four or more in Infants. It is the thickest and most compact of all the Bones of the Skull. It is said to have nine *Sinu*, two external, and seven internal. Of the internal the two largest are those that receive the protuberances of the *Cerebellum*. It has also five Protuberances, and five *Foramina*, of which the lowest and largest is that by which the *Medulla oblongata* passes out of the Skull into the Cavity of the *Vertebra*. The rest are less, and are for the transit of the Vessels.

These Bones of the Skull consist of two Tables or *Lamina*, all but the squamous part of the Temple-bones. The uppermost is hardest, thickest and smoothest: The lower is unequal, and pitted, to give way to the Vessels dispersed through the *Dura mater*. Between these two Tables there is a certain spongy substance, containing a marrowy and red juice, for the nutrition and humectation of the Bones, and is call'd *Diploe*. It is red, by reason of the many small Veins and Arteries passing that way. Many times in the Pox a virulent humour is gathered herein, which eats through and corrupts the *Lamina*, and causes most tormenting pains in the *Periosteum* and *Pericranium*.

CHAP. VI.

Of the Bones common to the Skull and upper Jaw.

Hitherto of the Bones proper to the Skull : Now follow those which are common to it and the upper Jaw. These are three : First, the wedge-like Bone, *Sphenoides* or *Cuneiforme* ; so called, not that it is like a Wedge, but that it is seated betwixt the Bones of the Skull and the upper Jaw. Before, it is joined with the Forehead-bone ; behind, to the *Os occipitis*. At the sides it doth accompany a good way the *Os petrosum*. Above, it doth touch the first, fourth, and sixth Bone of the upper Jaw ; and below, the Bones of the Palate of the Mouth by the wing-like Processes. It is thick in the middle, but thinner at the edges, and in the adult it consists of two *Lamina* and a *Diploe*, like the other Bones proper to the Skull. In Infants it consists of three or four. It has four external Processes, of which two, that are contiguous to the upper Jaw, are called *Aliformes* Wing-like ; and four internal also, that compose the *sella Turcica*, upon which the *Glandula pituitaria* lieth, that receiveth the pituitous excrements falling from the Brain by the *Infundibulum*. But this *sella Turcica* is not perforated, as we intimated from Dr. Lower in Book 3. Chap. 5. though that has been generally taught, supposing that the pituitous matter did destil through its holes upon the Palate, &c. whereas it is reformed by the Veins, as that learned Doctor affirms. It hath

hath sundry perforations, by which the motory and optick Nerves of the Eye, and other Nerves for the motion of other parts, as also Veins and Arteries do pass.

Os cribriforme.

The second common Bone is *Os cribriforme*, because, like a Sieve, it hath many holes, by which smells pass to the *Processus mammillares* or olfactory Nerves. It is covered with the *Dura mater*, and seated in the middle basis of the Fore-head at the top of the Nostrils, and is joined by the Sutures called *Harmonia* to the *Os frontis*, the second Bone of the upper Jaw and to the *Cuneiforme*. On its upper side in the middle it has growing upon it a kind of triangular process, like to the Comb of a Cock, which is therefore called *Crista galli*. And opposite to this in its lower side it has another that is thin and hard, dividing the Nose into two parts or Nostrils, the right and the left, and is called *Septum nasi*. To this *Os cribriforme*, in the cavity of the Nostrils, there adhere two other Bones called *Spongiosa*, because they are full of holes like a Pumice-stone. But most Anatomists consider them as parts of the *Os cribriforme*, confounding their names one with the other, calling this, *Os spongiosum* or *cribriforme* indifferently.

The third common Bone is *Os jugale*, or the Yoke-bone. It is placed on each side of the Face between the *Meatus* of the Ear and the first Bone of the upper Jaw, being framed of two Bones, of which the hinder is a process of the Temple-bone that is carried from the *Meatus auditorius*; and the fore-bone is a process of the first bone of the upper Jaw, which maketh the lower side of the lesser corner of the Eye. These two Processes are joined

joined by an oblique Suture, and make the *Os jugale*. It sustaineth the Tendon of the temporal Muscle which passeth to the lower Jaw, and that of the Muscle *Masseter*.

CHAP. VII.

Of the Jaws.

NOW follow the Bones of the Face, which are the Jaw-bones with their Teeth; to which we shall subjoin the Bone of the Tongue.

The Jaws are two, the *upper* and *lower*. The substance of the *upper* Jaw especially on its inside is not solid but spongy; and unequal, because it is framed of sundry Bones. They are six pair, six in each side. The *first* is *Zygomaticum*: this maketh up the best part of the *Os jugale*, and the outer corner of the Eye. The *second* is *Os lachrymale*. It is a round, little and thin Bone in the inner corner of the Eye, whereon the *Caruncula lachrymalis* resteth. In the lower part of it there is a hole which passeth to the cavity of the Nose: by this a branch of the fifth pair of Nerves passeth to the inner Membrane of the Nose. The *third* is thin as the former, but quadrangular. It is placed between the two former in the inner side of the orbit of the Eye, and is continuous to the *Os spongiosum* of the Nostrils. The *fourth* is *Os male*, the Cheek-bone, the greatest and thickest. This maketh up the greatest part of the Cheek and Palate, and containeth all the upper

Hh

Teeth

Teeth in its caverns. It is joined above, on that side next the Nose, to the Bone of the Forehead, but below with the wedge-like Bone; before with the *Os lachrymale*, behind with the third, and last of all with its fellow. Under the Eye it has a hole for the passage of a branch of the fifth pair of Nerves that is bestowed on the Face; and another near the bottom of the Nose, by which an Artery and a Vein pass from the Palate to the Nostrils. The *fifth* is long, hard, and reasonable thick; it with its fellow maketh up the bony part of the Nose. It is joined with the Cartilages of the Nose below, (to which purpose it is very rough and unequal on that side) but to the internal process of the *Os frontis* above. The sixth doth make up the Roof of the Mouth, (with its fellow.)

Six Bones then make up the orbit of the Eye. The first is *Frontale*, which maketh the upper vaulted part. The second is placed in the outside, where the lesser corner is, and is a portion of the wedge-like Bone. The third is the first Bone of the upper Jaw, and maketh up the outside, concurring with the former portion of the wedge-like Bone. The fourth and fifth are the second and third of the said Jaw, and make up the inside. The sixth maketh up the lower part. These are joined one to another partly by common, and partly by proper Sutures.

*The lower
Jaw.*

The lower Jaw in those of ripe age is but one Bone, but in Children, till they are a year or two old, it consists of two, which are joined together at the Chin by *Synchondrosis*, and afterwards grow into one. This is moveable, but the upper immoveable. It resembleth in shape the Greek letter *v*. At both the ends of it there are

TWO

two processes, whereof the one from a broad basis grows sharp, and is called *Corona*: this receiveth the Tendon of the temporal Muscle, which is also the first of the lower Jaw. The other may be called *Articularis*, because it serveth for Articulation. This has a Neck and a longish Head (called *Condylus*) that is covered with a Cartilage for its easier motion. By this Head it is articulated into the *Sinus* of *Os petrosum* that is also lined with a Cartilage, and is knit strongly thereto by a membranous Ligament. This Bone has a cavity within, especially in the fore part toward the Chin, which contains a marrowy juice for its nourishment. It has four *Foramina*; of which two are at the roots of the Processes, by which a branch of the fifth pair of Nerves together with a Vein and Artery pass to the Teeth; and two other in its fore-part by the sides of the Chin, by which two twigs of the said fifth branch pass out again to the lower Lip and its Muscles and Skin.

Both the Jaws have *Alveoli* or Sockets for the Teeth, in number equal with the number of the Teeth. But when in old age the Teeth fall out, the Sockets close together, so that in time there remains no print of them, but the Bone becomes sharp.

CHAP. VIII.

Of the Teeth.

THE Teeth are called in Latin *Dentes*, quasi *Edentes*, from their office ; and are fixed in the Jaw-bones as a Nail into a Post, by *Gomphosis*. Their root is tied to the Mandible by a Nerve, by *Syneurosis* ; and the upper part as far as 'tis compassed by the fleshy substance of the Gum, by *Syssarcosis*.

Their substance.

Their substance is the hardest of all other Bones. That part of them that stands out naked above the Gums is smooth and covered with no *Periosteum* ; but that part within the Sockets of the Jaws is rough and invested with a thin Membrane or *Periosteum* that is of exquisite sense. The Grinders have a manifest cavity within, (but the *Incisores* and Dog-teeth but an obscure one) whereinto by the very small holes of their roots they each receive a Capillary artery from the *Carotides*, a Vein from the Jugulars, and a twig of a Nerve from the fifth pair (as abovesaid) which last being expanded through the thin Membrane that invests the said cavity gives it a most acute sense ; but the bony substance of it self is wholly insensible. The Vein, Artery and Nerve are united together and clad with a common Membrane when they enter the Jaw, within which they have a proper channel to run along in under the roots of the Teeth, sending twigs to each as they pass under them.

Origine.

The rudiments or principles of the Teeth are bred

bred with the other parts in the Womb, but lie hid for some months within the Jaws and Gums, in which they encrease and are perfected by degrees, some breaking through the Gums sooner, others later, as every one may observe in Children. But though after such a term of man's life, no new Teeth spring; yet they grow continually as long as a Man lives, else would they be soon worn to the stumps by their daily use; and we see that when a Tooth is lost out of either Jaw, that which is opposite to it in the other Jaw, will grow longer than the rest, having none to grind against.

When Children come to be seven or eight *Change.* years old, they change several of their Teeth; but very rarely, if ever, all. The *Incisores* or Fore-teeth, the *Canini*, or Eye-teeth, and the foremost Double-teeth most change; but the rest of the Double-teeth very few. Now concerning this changing of the Teeth we must note, that the old ones do not come out by the roots, but their upper part only drops off, their root remaining still in the Socket of the Jaw, which (being like seed for the new ones) by degrees grows up above the Gums to supply the place of that which was fallen off. Commonly about the twentieth year (or upwards) there spring out two Double-teeth behind the rest, which till then had lain hid in their Sockets. These are called Genuine teeth, or *Dentes sapientia*, because Men are then come to years of discretion.

As for the *number* of them, commonly there are *Number.* found sixteen in each Jaw; if there fall out any difference in number as to individual persons, it commonly falleth out in the *Molares*.

The ANATOMY

There are three ranks of Teeth. Those of the first rank (or the foremost) are called *Incisores*, Cutters. Most commonly four are found in each Jaw: they have but one root or phang, and so easily fall out. These first make way out of the Gums in Children, because the tops of them are sharpest. Those of the second rank are called *Canini*, or Dog-teeth, from their length, hardness and sharpness above the rest. In each Jaw there are two, at each side of the Cutters one. They are commonly called *Eye-teeth*, either from an opinion that their roots (viz. of the upper) reach as far as the Eyes, or that the same Nerve that moves the Eye sends a twig to these Teeth; neither of which conceits are true. The roots of these are single as those of the *Incisores*, but they are both sometimes crooked; and if such people in whom they are so, chance to have one of them drawn, they can hardly be pulled out without breaking off a piece of the *Alveolus* in which they are fixt. Those of the third rank are called *Molares*, Grinders; because like Millstones they grind the meat. Most commonly they are twenty in number, five in each side of both Jaws. The two foremost that stand next to the Dog-teeth, are less than the rest, having but two knobs at the top, but the three hindmost are larger and have four, being in a manner foursquare. The two foremost also have but two roots at most, but the three hindmost commonly three or four. But those of the upper Jaw have for the most part one root more than those which are opposite to them in the lower. The reason whereof may be, first, because they hang; and secondly, because the substance

stance of the upper Jaw is not so firm as that of the lower.

The use of the Teeth is principally to chew the *use*. meat to prepare it for the Stomach, that it may the easier concoct it into Chyle. The *Incisores* bite off the morsel, the Dog-teeth break it, and the Grinders make it small; wherefore they are flat in the top, that they may the better receive and keep the meat, and rough, that they may grind it the better. The Teeth contribute also to the formation of the Speech, especially the Fore-teeth; for those that have lost them, lisp as we say, and cannot pronounce plainly such syllables as have C. X. &c. in them.

CHAP. IX.

Of the Bone of the Tongue called Os hyoides.

THIS Bone is seated under the lower Jaw, in the uppermost part of the *Larynx*. It is shaped like the Greek vowel *υ*, (whence it is also called *Os Ypsiloides*) or to the lower Jaw; because it is arched before, and extended with two points like horns behind. It is commonly compounded of three Bones. That in the middle is gibbous forwards and hollowinwards, and by its gibbous side is joined to the basis of the Tongue. The other two are lateral, and are called *Cornua*, or Horns. Each of these has a Cartilage adhering to it; and the middle, two. They are all tied to the adjacent parts, partly by a fleshy, partly by a nervous substance.

substance. In its *Sinus* it receiveth the *Epiglottis*. It moves together with the Tongue, and serveth to keep the Throat open, that the meat may descend into the Stomach, and the air have passage to the Wind-pipe while we speak and breath.

CHAP. X.

Of the Bones of the Neck.

Hitherto of the Bones of the Head, now follow those of the Neck.

They are of two sorts, to wit, the *Clavicula* or Channel-bones, and the *Vertebra*.

Claviculae. As to the *Clavicula*, some reckon them to the *Thorax*, others to the Shoulder; but considering their situation, they may as fitly be reckoned as pertaining to the Neck. They are called *Clavicula* from their resembling the shape of old-fashioned Keys, which were of the figure of an Itallick *s*; such as *Spigelius* says he has seen belonging to old Houses at *Padua*. They are not so crooked in Women as in Men. Their substance is thick and spongie, but more about the heads than about the middle. In number they are two, one on each side. Near the Throat they are round; but towards the Shoulder flattish. They are joined to two Bones, to wit, one end to the Shoulder-blade, and the other to the top of the Breast-bone. The use of them is to uphold the Shoulder-blades, that they should not fall upon the Breast together with the Shoulder-bone; which falleth

leth out, when there is a fracture in them.

The *Vertebrae* of the Neck are in number seven. *Vertebrae* The Bones of these are less, but harder than ^{seven.} those of the other, because they are more moved. These have first a large hollownes to give way to the *Spinalis medulla* to descend by : then two holes in their transverse Processes, one in each side, through which Veins and Arteries pass to the Head. Their Bodies have Processes oblique, transverse and posterious; which last are forked, except in the first and last *Vertebra*.

The first *Vertebra* is called *Atlas*, because the Head stands upon it, like a little World. It hath no Spine behind (only a little blunt knob) lest the two small Muscles of the Head springing from the second *Vertebra* should be hurt, when the Head is extended. It has two ascending and also two descending Processes, (otherwise called oblique) and both of them a little hollowed; the upper receiving the tubercles of the *Occiput*, and the lower the ascending Processes of the second *Vertebra*. Upon these the Head is moved forwards and backwards. The substance of this *Vertebra* is harder, solider, but thinner than that of the rest, because it is the least, and yet its cavity is biggest. Within on the fore-side of its great *Foramen*, it has a semicircular *Sinus* lined with a Cartilage, whereby it receiveth the tooth-like Process of the second *Vertebra*.

The second is called *Vertebra dentata*, because out of its upper side between its two ascending Processes, there springs a round, longish and hard Process, in shape like a Tooth, which being invested with a Cartilage is jointed into the fore-said *Sinus* of the first *Vertebra*, upon which as
upon

upon an *Axis* the Head turns round. And when a luxation happens here, the Neck is said to be broken. This tooth-like Process in that part which enters not into the said *Sinu*, is environed with a Ligament, by which it is knit to the *Occipus*. The hinder Processes of this *Vertebra* are cleft into two, as those of the four following are, for the better connexion of the Muscles and Ligaments. Its transverse Processes are less than theirs, and have also smaller holes.

The four that lie under these, in all things are like them, save that their lateral Processes are larger, and divided into two as well as the hinder. The seventh is the largest of all. It is liker to the *Vertebra* of the *Thorax* than of the Neck; for neither are its transverse Processes like the foregoing, nor is its hinder one forked, but both are like those of the *Thorax*, to be described in the next Chapter.

CHAP. XI.

Of the Vertebrae of the Thorax.

THE Bones of the *Thorax* are the *Vertebra* of the Back, the Ribs and Breast-bone.

*Vertebrae
twelve.*

As for the *Vertebra*, they are twelve in number, unto which so many Ribs answer; whereof seldom doth one abound, more seldom lack. Their Spines or hinder Processes are not divided into two as those of the Neck, but are solid and simple. The transverse are short and blunt, and have each

each a shallow *Sinus* for the inarticulation of the Ribs; but are not perforated like those of the Neck. The oblique Processes are four, two ascending, and two descending: these serve for articulation. The descending are a little hollowed, and receive the (something protuberant) heads of the ascending Processes of the next *Vertebra* below them, successively. The forepart of their body next to the cavity of the *Thorax* is round. As for their holes, they have a large one in the middle, which containeth the marrow substance; and two lesser besides, on each side one, betwixt their jointings one with another, for the egress of the Nerves, and ingress of the Veins and Arteries.

CHAP. XII.

Of the Ribs.

THE Ribs are twelve in number. Their substance is partly bony, partly cartilaginous; the first serving for firmness, the second for articulation, and the easier motion of the Breast in respiration. The bony substance towards the *Vertebra* of the Back is thick and roundish, but towards the *Sternum* flat and thin. Within, it is fungous or spongie, whence the Ribs being broken are more readily joined together by a *Callus* than most other Bones. The Cartilages in bigness answer the bigness of the Ribs: for the bigger Ribs have the bigger Cartilages; and on the contrary. The Ribs in the upper

upper side are blunt or broadish, but in the under sharper. In the lower and inner side they have a furrow that runs along them to receive the Inter-costal vessels, the Veins, Arteries and Nerves.

The Ribs are of two sorts ; for they are either *long*, or *short*.

Seven ve-
riz.

The *long* (otherwise called the *true Ribs*) are seven in number (being the uppermost) and by their cartilaginous productions are immediately knit to the Breast-bone by the articulation called *Arthrodia* ; for in the Breast-bone there are an equal number of Cavities, which receive their cartilaginous heads. Their bony end is covered with a Cartilage and articulated into the shallow *Sinus* of the transverse Processes of the *Vertebra* of the Back by *Synarthrosis* ; and is knit to the said *Vertebra* by very strong Ligaments.

Note that the Cartilages of these true Ribs are usually observed to be harder in Women than in Men ; which may seem to be for the better sustaining of the weight of their Breasts that lie upon them.

Five no-
thz.

The *short* (otherwise called *Nothe* or *Spuria*, bastard Ribs) are five in number ; of which the four uppermost having their Cartilages bending upward and cleaving one to another are joined before to the lower side of the Cartilage of the seventh true Rib : but the last, which is the least, grows sometimes to the Diaphragm, and sometimes to the *Musculus rectus* of the *Abdomen*, as also sometimes does the lowest of the four next above it. Behind they are joined to the *Vertebra* of the Back, like as the true Ribs were.

Use.

Their use is *first*, to keep the Breast and the upper part of the *Abdomen* distended, that in the former

former the Heart and Lungs may have free space for their motion; and in the latter, the Stomach and Liver might not be prest upon by the circumjacent parts. *Secondly*, to preserve those parts from external injuries, as from bruises or the like. And *lastly*, to sustain the Muscles that serve for respiration, and to promote their motions; for if the Breast had been environ'd with one continued Bone, it had not been capable of dilatation in inspiration, nor of contraction in expiration.

CHAP. XIII.

Of the Breast-bone or Sternum.

THIS Bone is seated in the middle of the *Thorax* before, serving as a Breast-plate, and having the cartilaginous productions of the true Ribs inarticulated into it. It is of a red fungous substance, and in children almost wholly cartilaginous, only its uppermost part is somewhat more bony than the rest, perhaps because one end of the *Clavicula* is jointed into it. In Infants it consists of seven or eight, but after some years they so coalesce one to another, that in the adult it is compounded but of three, and in aged persons it seemeth but one Bone, yet it is distinguished by two transverse lines, shewing the former division, which are more conspicuous in the inside than outside.

The uppermost Bone is thickest and broadest;
it

it hath in each side a longish cavity, lined with a Cartilage, to receive the points of the Channel-bones; between these in its middle and upper part is a pit called *Jugulum*. It has also a small cavity on the inside, to give way to the Wind-pipe descending. The second bone is neither so thick nor broad, yet four times as long. It is joined to the former by an intervening Cartilage, and in each side has five or six cavities for the articulation of so many of the true Ribs. The third is least of all, yet it is broader than the second, unto the lower end of which it is joined. What Ribs were not jointed into the middle Bone, are received by this. To its lower end is annexed the Cartilage called *Mucronata* or *Ensisformis*, Sword-like. This Cartilage is triangular, about an inch long, and on the outside of it there is formed a cavity in the Breast, called *Scrobiculus cordis* or Heart-pit; and the gnawing pains felt there, *Cardialgia*; though those pains are not from any affection of the Heart, but of the upper orifice of the Stomach, which lies under this Cartilage.

CHAP. XIV.

Of the Vertebrae of the Loins.

TH E Bones belonging to the *Abdomen* are these; five *Vertebra* of the *Loins*, five or six of *Os sacrum*, *Os coccygis* and *Os ischii*.

The five *Vertebra* of the *Loins* are larger than those of the *Breast*, and the lowest of them are biggest. They are jointed with the last *Vertebra* of the *Back* and the first of *Os sacrum*, and with one another, by an intervening clammy Cartilage, but more loosely than those of the *Back*, because the *Body* bends more upon them. They have each one large hole, to give way to the *Spinalis medulla*; and two small, by which *Nerves* pass out to the adjacent parts, and *Veins* and *Arteries* come in. As for their *Processes*, their posterious (or *Spines*) are shorter and more blunt, but broader and thicker than those of the *Vertebra* of the *Thorax*, and turn something upwards; but their lateral are longer. They also differ in their inarticulation, one with another; for whereas in those of the *Thorax* the upper *Processes* were knobby, and the lower hollow, to receive them; in these the contrary is seen; for the upper *Processes* are hollow, and the lower knobby. Only the last or twelfth *Vertebra* of the *Thorax* has both its ascending and descending oblique *Processes* hollowed to receive the heads or knobs of the *Processes* of the last but one of the *Thorax*, and the first of the *Loins*.

CHAP. XV.

Of the Os sacrum, and Os coccygis or Rump-bone.

THE *Os sacrum* is the broadest of all the Bones of the Back, and doth sustain all the other *Vertebrae*. On the inside it is smooth and hollow, on the outside convex and uneven, being of something a triangular shape. In its upper part on each side it is knit firmly to the *Ossa Ilii* by an intervening Cartilage. It consists of five or six Bones, plainly distinguishable in Infants, but more obscurely in grown persons. These Bones have the resemblance of (and are usually called) *Vertebrae*, for each of them hath a Body and Processes, and a large hole to receive the *Spinalis medulla*. In this, these differ from the other *Vertebrae*; because in those, the lower part is bigger, but in these the lesser; wherefore the uppermost of them is the biggest, and the lowest the least. Besides the large cavity to receive the *Spinalis medulla*, they have other lesser for the egress of the Nerves; and these are not in their sides, as those of the *Vertebrae* of the Neck, *Thorax* and Loins, but before and behind, between their jointings: of these holes those before are much larger than those behind. As for their Processes, the oblique can hardly be discerned, except in the first. The transverse are pretty long, but so united, that all seem but one. The hindermost are like the *Spine* of the Loins, but less, and still the lower the lesser; insomuch that the lowest hath

hath no Process, but only a round Protuberance.

To the *Os sacrum* the *Os coccygis* or Rump-bone is joined by a Cartilage, somewhat loosely, that it may bend a little backwards in Women in travail for the freer passage of the *Fetus*, &c. It is compounded of three or four Bones, of which the first hath a small hollownes which receiveth the last *Vertebra* of *Os sacrum*. The rest of its Bones grow each less than other, so that the lowest ends in a cartilaginous point. It is called *Os coccygis*, because in shape it resembleth the Cuckow's bill. Its lower end bends inward, to stay the streight Gut and the sphincter Muscle, which are tied to it. The Bones of it are spongy and soft, and have neither Process nor any hollownes, for the spinal marrow descends no further than the bottom of *Os sacrum*.

CHAP. XVI.

Of the Hip-bone.

THIS Bone was by *Galen* called *Os innominatum*, because it had then no proper name imposed upon it, that he had met with. But *Homer* had long before him called it *ἰσχίον*, from whom it is now generally known by that name. There is one on each side, and they are knit to the sides of *Os sacrum* (through the intervention of a Cartilage) by a most strong Ligament, and together with it frame the *Pelvis*, or that cavity in which the Womb, Bladder and part of the In-

testines are contained. In Children it plainly appeareth to be framed of three Bones (called *Os Ilium*, *Coxendicis*, and *Pubis*) joined by a Cartilage, untill the seventh year; but in Men of ripe age these three, the Cartilage being dried and harden'd into a Bone, seem but one entire Bone. However for the more exact description of its parts, we must consider it as consisting of three.

Os ilium. The first is called *Os Ilium*, because under it lieth the small Gut called *Ilium*. This is the uppermost and broadest; in figure, semicircular; arched without, within hollow. Its edge which makes the semicircle is called *Spina*, the arched part *Dorsum*, the hollow part *Costa*. It is joined with the *Os sacrum* by a common membranous and most firm Ligament, with a Cartilage intervening, as abovesaid.

Coxendix. The second is called *Os coxendicis*, by some particularly *Os ischium*, and in English the Hip-bone: though more commonly both these last names are taken in a larger signification, and include all the three. This Bone is the lower and outer part of *Os innominatum*, and has a large cavity in it (which is called *Acetabulum coxendicis*) which receives the round head of the Thigh-bone, by the articulation called *Enarthrosis*. The brims of this Cavity are tipt as it were with a Cartilage, called its *Supercilium*. Its lower end has a large *Appendix* which we lean or bear upon when we sit.

Os pub's. The third Bone is called *Os Pubis*, and *Peſſinis*, or the Share-bone. It is seated in the fore-part, and in the middle it is joined to its fellow by a Cartilage, which is much thicker, but looser and softer

softer in Women than in Men. It has a very large *Foramen* in its middle, which makes it the lighter. And above, it has a *Sinus*, by which the crural Veins and Arteries pass to the Thighs. The *Pelvis* that is composed by these three Bones and the *Os sacrum*, is bigger in a Woman than in a Man, to make the larger room for the *Fetus*.

CHAP. XVII.

Of the Scapula or Shoulder-blade.

NOW follow the Bones of the Limbs, which are the *Legs* and *Arms*. The Bones of the Arms are either *above* the joint of the Shoulder, or *under*.

Above the joint lieth the *Shoulder-blade*, in Greek called *σκαπυλα*, in Latin, *Scapula*. The substance of it is for the greatest part thin, but hard and solid. The outside is somewhat arched, but the inside hollow. It is somewhat of a triangular figure, and joined to sundry parts by means of the Muscles; which sort of union we called *above*, *Syffarchosis*. Thus it is joined with the Bone of the *Occiput* by the cucullar Muscles or the first pair that move the *Scapula*; to the *Vertebra* of the Neck by its second pair; and to the Back by the Muscle *Rhomboides*. It has three Processes: of which the first is extended along its middle, and is called its Spine; and that end of it that by a shallow *Sinus* receives the *Clavicula*, *Acromium*, its point or tip. The second is lower, less and

acute, something like a Crow's Bill, whence it has the name of *Coracoides*; by others it is called *Ancyroides*, Anchor-like. The third is the shortest, called *Cervix* its Neck, which ends in a *Sinus* that in its upper part is acute, but in its lower round: this cavity being but shallow of it self has its brims tipt with a Cartilage, which makes it the deeper, in which the head of the Shoulder-bone is jointed. This jointing is strengthened by very strong Ligaments and Tendons, and is partly hindred from luxation by the top of the second Process.

The Shoulder-blade hath a three-fold use. First, it receiveth the *Os humeri* in the cavity of its third process by the articulation called *Arthro-dia*; as it does the *Clavicula* in the *Sinus* of its first process by *Synarthrosis*. Secondly, sundry Muscles spring from the Shoulder-blade, which serve for the motion of the Shoulder-bone. Thirdly, it defendeth the Back, so far as it reacheth, from external injuries, like a Shield.

CHAP. XVIII.

Of the Os humeri or Shoulder-bone.

THE Bones of the Arm under the joint of the Shoulder are the Shoulder-bone, the Cubit-bones, and the Bones of the Hand.

The Shoulder-bone is but one in each Arm, reaching from the Shoulder to the Elbow. In figure it is round, only a little flattish behind towards

wards the Elbow ; of a hard and solid substance. It is hollow all along like a Pipe, wherein a marrowy substance is contained. That end that is jointed to the *Scapula* has a great and round head, cover'd with a Cartilage, which is received into the cavity of the *Scapula* by that kind of articulation which is called *Arthrodia*. On the hinder side of this head there stand two rough and uneven Prominences, into which the Ligaments are inserted. And betwixt these two Prominences there is a round and long chink through which the nervous head of the *Musculus biceps* doth pass. Its lower end is articulated with two Bones, viz. the *Ulna* and *Radius*, by *Ginglymus*, for it both receives them and is received by them, having three Processes and two *Sinus* betwixt them ; so that by these it resembles a Pulley, whence it is called *Trochlea*. The *Ulna* is jointed with its inner side, and the *Radius* with the outer. On its inside, besides the three foregoing, it has a large Process or Tubercle from whence those Muscles arise that lie on the inside of the Cubit ; and another less on its outside, from which those Muscles spring that lie on the outside. On the hinder side of the *Trochlea* there is one deep large cavity, and on the fore side two small ones, into which the Bones of the Cubit hit, when they are moved backward or forward, and are stopped from being carried further. About the middle of this Bone in the inside, you may perceive a hole, through which Vessels pass to the marrowy substance for nourishment.

CHAP. XIX.

Of the Bones of the Cubit.

These are in number two; to wit, the lesser above called *Radius*, and the larger below called *Ulna*. Their substance is firm and solid, all but their appendages. They are near of the same length (but the *Ulna* is the longer of the two) and both have a cavity in which they contain a marrowy substance. They are somewhat rough in their superficies by reason of their lines that are appointed for the rise or insertion of the Muscles.

Ulna,

The *Ulna* is larger in its upper end that joints with the *Os humeri*, and grows smaller and smaller towards the Hand, ending into a round Tubercle, with a round *Sinus* in it, (having on its hinder side a small sharp Process, from its shape call'd *Stryloides*) whereby it is knit (by *Artbrodia*) to the little Bones of the Wrist, by Ligaments, (a Cartilage intervening.) Its upper end is articulated with the *Os humeri* by *Ginglymus*, to which end it has two Processes, of which the hinder enters into the hinder cavity of the Shoulder-bone behind the *Trochlea*, (by which the Cubit is stayed from further extension than to a streight posture) and is called *Ancon* or *Olecranon*. And at the same end it has also two *Sinns*, by the outer and less whereof it receives the head of the *Radius*, and by the hinder and larger one of the Processes of the *Os humeri*, which moves in it as a Rope in a Pulley. As it receives the *Radius* in its

its upper end, so is it received by it in its lower : but in the midst it bends or recedes a little from it, yet is knit to it by a long Ligament.

The second Bone is upper and something shorter, called *Radius*. Its upper end is slenderer, having a round head, one side of which is received by the *Ulna* ; but its tip has a round shallow cavity in it, which receives a Process of the *Os humeri*, by *Diarthrosis*. Its lower end is thicker, which by a little *Sinus* in its side receives the *Ulna* ; and at its extremity it has two other small *Sinus*, into which it admits the two first and highest Bones of the *Carpus*. Radius.

CHAP. XX.

Of the Bones of the Hand.

THE Hand is divided into three parts : the Wrist, called *Carpus* ; the distance between the Wrist and Fingers, called *Metacarpus* ; and the Fingers themselves.

The Bones of the Wrist are eight in number, whereof there are two ranks or orders. The upper rank hath three Bones so joined together, that they seem but one ; these are articulated to the *Ulna* and *Radius* by *Arthrodia* : but the fourth being the least of all, is placed a little out of its rank on the outside of the third. The inferior hath four Bones ; they are joined to one another by *Harmonia*, but to the Bones of the *Metacarpus* by *Arthrodia synarthrodes*, having some motion

Bones of
the Carpus
eight.

though but obscure. They are firmly knit to one another by both a membranous and cartilaginous Ligament; and besides, by another called *annular*, which compassing the Wrist, comprehendeth both them and the Tendons of the Muscles which pass to the Fingers.

Of the
Metacar-
pus four.

The *Metacarpus* hath four Bones; they are of a solid substance, round, hollow within like a Pipe, being full of marrow. They are bigger than those of the Fingers: that which answereth the Fore-finger is thickest and longest, and the rest grow each shorter and slenderer than the foregoing. Between each two a distance is left for the *Musculi interossei* of the Fingers. Both in their upper and lower end they have an *Appendix*; by the upper they are joined to the little Bones of the Wrist, by the lower to the Fingers: the upper hath a cavity, and so receiveth the Bones of the *Carpus*; but the lower a round long head, covered with a Cartilage, and is received by the *Sinus* of the Fingers.

In the Palm of the Hand there is a transverse Ligament, which doth tie the Bones of the Fingers to the *Metacarpium*.

Of the fin-
gers fifteen.

The Fingers (taking in the Thumb) have fifteen Bones, each three. The first are largest, the second less, and the third the least. On the outside they are round, but on the inside plain and a little hollow, that they may lay the firmer hold upon things. Each has a Process at each end. The upper Processes are round, and those of the first Bones have one round *Sinus* in them whereby they receive the round head of the Bones of the *Metacarpus*: but the upper Processes of the second and third Bones have each two *Sinus*, parted

parted by a small Protuberance. The lower Processes have two heads divided by a *Sinus*, which are received by the double *Sinus* of the upper Process of those Bones that join to them: except only the last or third Bone, which is received by none, but is fenced by a Nail. The second Bone is joined to the first, and the third to the second by *Ginglymus*, and by them the Fingers are only stretched out and contracted. For as for their motion sideways, that depends only upon the articulation of the first Bones with the Bones of the *Metacarpus*, which is done by *Enarthrosis*, or at least by *Arthrodia*. The jointings of the Thumb answer to these of the Fingers, saving that its upper appendix is not joined to any Bone of the *Metacarpus* (with which it has no communication) but immediately to the Wrist; and its lower has but one head, whence the second Bone has but one *Sinus* in its upper appendix to receive it.

Besides these Bones there are in the inside of the Hand, at the joints of the Fingers, some small Bones called from their figure and bigness *sesamoides*, like the Grains of *Sesama*, (a sort of Indian Corn so called by *Pliny*.) They resemble in figure the Knee-pan, and seem to serve for the same use; for in strong extensions of the Fingers they strengthen the Tendons of the Muscles upon which they are placed, and hinder the luxation of the joint. Authors differ very much as to their number, because being so small they are seldom all found: but most agree upon the number of 12 to each Hand, placing them thus. At the second joint of the Thumb there are two. The second and third joint of the Fore-finger have each one; but its first joint, as also the first of the other three have

Ossa sesamoides.

have each two. In Children they are of a cartilaginous substance, but grow bony by degrees, (being invested with a Cartilage) yet not solid but fungous or porous.

CHAP. XXI.

Of the Thigh-bone, and Patella.

THE Leg (in a large sense) is divided into three parts, the Thigh, the Shank (or Leg strictly so called) and Foot.

Os femo-
ris.

The *Thigh* hath but one Bone : but of all others it is the longest and thickest. *Before*, it is round : but *behind*, something depressed and hollow. In the *upper* part it has a round head ; the slender part under this is called its Neck, and is pretty long and oblique. The Neck is an *Apo-physis* or process to the Bone it self, and the round Head an *Epiphysis* or Appendix to the Neck. This Head is received by the large Cavity or *Acetabulum* of the *Coxendix*, and is detained therein by two strong Ligaments ; one that encompasses the brims of the *Acetabulum*, and another that springs out of its bottom, and is inserted into the tip of this round Head or *Appendix*. At the lower end of the Neck there spring two Prominences ; which, because the Muscles called *Rotatores* are fastned to them, are called *Trochanteres*. The hinder and lower is the lesser *Trochanter* ; and the lateral or uppermost, the bigger. The lower end of the Thigh-bone growing thicker by degrees hath

hath two pretty large Prominences or Heads, leaving a cavity in the middle which receiveth the *Apophysis* of the *Tibia*: And again these Prominences are received by the cavities of the *Tibia*, by a loose *Ginglymus*, both the Prominences and Cavities being lined with Cartilages. The fore-part of this articulation is called the Knee, the hindermost the Ham.

Upon the Knee appeareth a Bone, not joined *Patella* with any other Bone, called the Pan, or *Patella*: it is roundish, about two inches broad, plain without, having many holes; but within bunched, covered with a Cartilage. It is set before the Thigh-bone and the *Tibia*, to strengthen the articulation; for otherwise the Thigh-bone would be in danger to slip out forward in going down a Hill, or the like. It cleaveth to the Knee by the thick Tendons of the second, third, and fourth Muscles that extend the *Tibia*, which pass under the *Patella* to it, and are implanted into its fore-knob. Two Ligaments fasten the articulation of the Thigh-bone with the *Tibia*: the one fastens the Cartilage that environs the brims of the *Sinus* of the *Tibia*, the other rises out of the *Apophysis* of the *Tibia*, and is inserted into the *Sinus* of the Thigh-bone.

Behind there are two *Ossa sesamoidea*, which adhere to the two beginnings of the first Muscles which move the Foot, to strengthen them. Great wounds of the Ham are mortal, by reason of the great Vessels which pass that way.

CHAP. XXII.

Of the Bones of the Shank.

THE Shank (or Leg strictly so called) is composed of two Bones. The greater is called *Tibia*, the lesser *Fibula*. These are slightly articulated into one another near each end; but in their middle they recede one from the other, yet so as they are tied together by a strong Ligament that comes between them.

Tibia.

The *Tibia* (commonly called *Focile majus*) is partly triangular, by its sharp edge before making what we call the Shin. It has an appendix at each end. That above is bigger, and in its upper part hath one Process, which is received by the *Sinus* of the Thigh-bone; and two longish Cavities for the receiving of the two Prominences of the Thigh-bone, (so that the articulation is by *Ginglymus*) as was said in the foregoing Chapter. About the brims of these *Sinus* there is joined by Ligaments a moveable Cartilage, soft, slippery, and bedewed with an unctuous humour, called *Cartilago lunata*, the Moon-like Cartilage. It has also a little Head behind (below the fore-said appendix) which enters into the *Sinus* of the upper appendix of the *Fibula*. Its lower appendix is less than the upper, jetting out with a notable Process toward the inside of the Foot, making the *Malleolus internus* or inner Ankle. It has two Cavities; one less in its side, by which it receives the *Fibula*; another greater and lower, divided as it were into two by a small Protuberance
in

in the middle, and lined with a Cartilage, receiving the convex head of the *Talus* that lies under it; as the said Protuberance is received by the shallow *Sinus* in the convex head of the *Talus*: the one being articulated into the other by *Ginglymus*, so that the Foot moves upwards and downwards upon this joint.

The lesser and outer Bone of the Leg is called *Fibula*. *Fibula* (or *Fecile minus*;) it is as long as the former, but much slenderer. This has also an appendix at each end: the upper of which reaches not so high as the Knee, nor is it jointed to the Thigh-bone; but in its inner side has a shallow Cavity which receives the little hinder (or lateral) Head of the *Tibia*, that is seated under its upper appendix which is jointed with the Thigh-bone. Below, the *Fibula* is received by the *Sinus* of the *Tibia*, and extends its appendix with its process to the side of the *Talus*, making the *Malleolus externus* or outer Ankle, which is lower than the inner.

CHAP. XXIII.

Of the Bones of the Tarsus.

OF the Foot (as of the Hands) there are three parts, *Tarsus*, *Metatarsus*, and the Toes.

The *Tarsus* is the distance between the lower end of the two *Focils*, and the beginning of the five Bones which are articulated with the Toes.

The Tarsus hath seven bones.

It

It hath seven Bones much differing from one another in bigness and shape.

1. Talus. The first is called *Talus* or *Astragalus* (in English the Ankle or Huckle-bone.) This is of a various figure: *above*, it has something a convex head with a shallow *Sinus* in it, articulating with the *Tibia*, as is described in the foregoing Chapter. By the process of the *Tibia* that makes the inner Ankle it is hedged in as it were on the inside, as it is by that of the *Fibula* on the outer. *Before*, it has a long neck, on which grows a round head that enters into the *Sinus* of *Os naviculare*; upon which jointing the Foot is moved sideways. Its *hinder* side is rough, and in its upper part has a transverse *Sinus* for the receipt of the Ligament of the *Tibia*, and in its lower a little descending *Sinus*, by which the Tendons of the Muscles pass. *Below*, it has a *Sinus* behind and a Protuberance before, by which it is articulated with the Heel-bone by *Ginglymus*. Betwixt the *Sinus* and Protuberance there is a long and pretty deep Cavity, and over against it another such in the Heel-bone. In these is contained a mucous substance which moistens the cartilaginous Ligaments that join the *Talus* to the Heel-bone, keeping them from drying by continued motion.

2. Os calcis. The second Bone of the *Tarsus* is called *Os calcis* or *Calcaneus*, the Heel-bone, and is the biggest of the seven. It lies under the *Talus*, with which in its *upper* side it is articulated in the manner just now described. *Behind*, it receiveth the great Tendon called *Nervus Hectoreus*, composed of the Tendons of three Muscles of the Shank. Its *fore* end is received by the *Os cubiforme*. On its *inside* it has a large *Sinus*, by which the Tendons and
larger

larger Vessels descend to the lower parts of the Foot; and on its *outside* it is uneven with several knobs, for the firmer connexion of the Ligaments and Tendons.

The *third* is called *Os Naviculare* or *Cymbiforme*, ^{3. Os naviculare.} from its figure. *Behind*, it receiveth the *Talus* in a large *Sinus*; but *before*, it is convex, with three flattish smooth heads that are admitted into the very shallow *Sinus* of the three *Ossa cuneiformia* or lesser Bones of the *Tarsus*.

The remaining *four* are less than the three already described, and stand all in one rank; the first of them articulates with the Heel-bone, the other three with the *Os naviculare*. There is no Cartilage betwixt them, but they are knit one to another on the outside by a cartilaginous Ligament; and are cover'd both in their hinder and fore-part with a smooth Cartilage where they are jointed with other Bones. The first is called *Cubiforme* or Die-like, having six sides. This is ^{4. Os cubiforme.} bigger than the other three that follow, and is seated on the outside of the Foot. In its *fore-side* it is joined to the fourth and fifth Bone of the *Metatarsus*; in the *hinder* with the Heel bone; and in the *inside*, to the third Bone of the *Cuneiformia*: but its other three sides, *viz.* the *outer*, *upper* and *lower* are joined to none.

The three ensuing are called *Cuneiformia*, or ^{5. Three Cuneiformia.} wedge-like Bones; for above they are thick, and below thinner, so that being joined, they represent a Vault, being convex on the upper side, but on the under hollow; in which hollowness the Tendons and Muscles are lodged, so that one does not press upon and bruise them in going. The first of these Bones is the greatest, seated in the

the inside of the Foot; the second is the least, placed in the middle; the third is in the mean between both in bigness. These three *behind* are joined to the *Os naviculare*, and *before* to the three first Bones of the *Metatarsus*.

CHAP. XXIV.

Of the rest of the Bones of the Foot.

*The bones
of the In-
step five.*

THE *Metatarsus*, or *Instep*, hath five Bones: for one is appointed for the sustaining of the great Toe, as well as others for each of the rest; though in the Hand it is not so, where the Thumb has no Bone in the *Metacarpus* answering to it.

They are solid without, but hollow within; and are longer than the Bones of the back of the Hand. That which stayeth the great Toe is thickest, but the longest is that which stayeth the next Toe: the other three grow each shorter than other, but are almost of an equal thickness. Their lower ends being round are inserted into the *Sinus* of the first joints of the Toes: but the upper in their own shallow *Sinus* receive the Bones of the *Tarsus*.

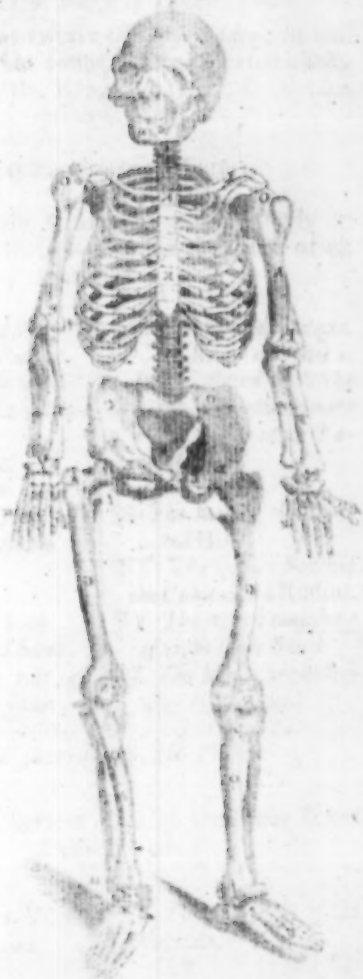
*Of the Toes
fourteen.*

The Bones of the Toes are in number fourteen; for the great Toe hath only two, but the rest three. These bones are solid without, and hollow within like those of the Instep. Their articulation is altogether like that of the Fingers, so that we shall not need here to describe it over again.

Each

PLATE I

Fig. 1





Each Foot has twelve *Ossa sesamoidea*, as well as the Hands: but seeing they are seated wholly alike in both, the Reader may please to turn back to their description in Chap. 20.

The Explanation of the Figure.

It representeth the *Skeleton* of an adult Body on the fore-side, that the mutual contexture of all the Bones may appear.

A	The Forehead-bone.		with the Shoulder-blade.
bb	The Coronal Suture.	PP	Its lower end that is
C	The Temple-bone.		inarticulated with the
d	The Mammillary Pro-		Ulna & Radius, where
	cess.	q	points at the inner Tu-
E	The Os jugale.		bercle, and
F	The upper Jaw.	r	at the outer.
GG	The lower Jaw.	SS	The Bone of the Cubit
hhh	The Vertebrae of		called Ulna.
	the Neck,	TT	The other Bone of
iiii	The Ribs.		the Cubit called Radius.
KK	The Breast-bone.	YY	The Wrist consisting
LL	The Channel-bones.		of eight little Bones.
MM	The inner side of	ZZ	The Metacarpus ha-
	each Shoulder-blade.		ving four Bones.
NN	The Shoulder-bone.	aaa	The Fingers.
OO	Its Head jointed	22	The Thumb.

The following Letters point at the lower Bones of the *Skeleton*.

Aaaaa	The five Verte-	BB	The inner side of Os
	brae of the Loins.		sacrum.
		Kk	
		CC	The

- | | | | |
|------|--|------|---|
| CC | The cavity of Os Ilium, making a great part of the Pelvis. | OO | The Tibia. |
| DD | The Coxendix. | pppp | Its upper Process. |
| EE | The Ossa pubis. | rr | Its Spine that makes the Shin. |
| F | The middle line that joins the two Bones of the Pubes together, by the mediation of a Cartilage. | ss | Its lower Process that makes the inner Ankle. |
| GG | The Thigh-bone. | TT | The Fibula. |
| hh | Its round Head. | uu | Its lower Process that makes the outer Ankle. |
| ii | Its Neck. | XX | The Tarsus consisting of seven Bones. |
| kk | The outer Process of its Neck, or the greater Trochanter. | a. | The Astragalus. |
| ll | The inner Process, or lesser Trochanter. | β | The Heel bone. |
| mmmm | The lower heads of the Thigh-bone. | d | The Os cubiforme. |
| NN | The Patella or Knee-pan. | YY | The Metatarsus consisting of five Bones. |
| | | ZZ | The Bones of the Toes, in all fourteen, viz. two of the great Toe, and three of each of the rest. |

CHAP. XXV.

Of a Cartilage.

AS an Appendix to the Doctrine of Bones we will add a word or two of the *Cartilages* and *Ligaments* of the Body ; becaufe the former come neareft to the nature of Bones ; and the latter, as they tye feveral other parts one to another, fo efpecially the Bones.

A Cartilage is a *similar part, cold, dry and void of fenfe, flexible and not fo hard as a Bone.* But when by age its glutinous particles are dried up, it many times degenerates into a Bone.

As for the Cartilages of the Eye-brows, Ears, Noſe, *Larynx*, &c. we ſhall not need here particularly to deſcribe them, having done it where we treated of the reſpective parts ; only we will note in general, that all the Bones in their articulations one with another, are covered or lined with Cartilages, whereby their motion becomes more eaſie and glib : and ſometimes themſelves are the medium by which Bones are joined, which articulation is called *Synchondroſis*, ſuch as that of the *Oſſa pubis* : and laſtly, by tipping as it were the brims of the Cavities of the greater joints, they make the *Sinus* deeper.

CHAP. XXVI.

Of a Ligament.

A Ligament is a similar part, cold and dry, of a middle substance betwixt a Cartilage and a Membrane, appointed for the tying of sundry parts together.

Note, that as it is either harder or softer than is suitable to its proper nature, it acquires the epithets of *cartilaginous* or *membranous* respectively: so, that which proceeds out of the top of the Thigh-bone and is inserted into the cavity of the *Coxendix* is called a cartilaginous Ligament, for its hardness; and that which environeth the joint of the Shoulder, is called membranous, from its softness.

Those which tie Bones together are without sense, (for otherwise upon every motion we should have been in pain:) but those that knit other parts together, (as those that tie the Liver, Womb, &c. to the neighbouring parts) are sensible.

Ligaments are found in several parts of the Body. As first, the Head being moved upon the first and second *Vertebra* of the Neck, there are four Ligaments to strengthen the articulation. Secondly, a common membranous Ligament begirts the whole articulation of the lower Jaw with the Temple-bone. Thirdly, the Bone at the root of the Tongue has four, by which it is tyed to the neighbouring parts; and the Tongue it self has one strong one on its under-side, (otherwise

wife called its *Franum*) which being two short or running too near its tip, hindreth its motion. Children being so troubled, are said to be Tongue-tyed, and must have it cut. Fourthly, both the Bodies and Processes of all the *Vertebra* of the Back are knit together by Ligaments, as also are the Ribs with the *Vertebra* behind, and with the Breast-bone before. Fifthly, sundry are to be seen in the *Abdomen*. The first tieth the *Os ilium* to *Os sacrum*. The second knitteth the *Os sacrum* to the *Coxendix*. The third and fourth knit the Share-bones together, one of them compassing them circularly, and the other, which is membranous, possellling their very *Foramen*. As for the Ligaments of the Liver, Bladder, &c. those were discoursed of when we described those parts in Book 1. Sixthly, in the Arm these appear.

1. Five tie the *Os humeri* to the Shoulder-blade.
2. The Bones of the Cubit, *Ulna* and *Radius*, are tied first one to another; secondly, to the Shoulder-bone; and thirdly, to the Wrist by (mostly) membranous Ligaments.
3. There are annular Ligaments at the Wrists, which being transverse, confirm and make steady the Tendons which pass to the Fingers. They are two; one in the outside, for the Tendons of the extending Muscles; the other in the inner side, for the Tendons of the contracting Muscles.
4. The Bones of the Wrist, back of the Hand and Fingers, have membranous Ligaments.
- Seventhly, In the Leg are these.
 1. The Thigh-bone is tied to the *Coxendix* by two Ligaments.
 2. The lower end of it is tied to *Tibia* and *Fibula* by six Ligaments.
 3. The *Tibia* is joined to the *Fibula* by three membranous Ligaments, viz. two common and one

proper. 4. *Tibia* and *Fibula* are joined to the *Talus* by three Ligaments, and there are three other for the strengthening of the Tendons. 5. The *Talus* is tied with the other Bones of the Foot by five Ligaments. 6. The Bones of the Instep and Toes are tied with such Ligaments as those of the Hand are.

CHAP. XXVII.

Of the Nails.

IN the last place we will say something of the Nails, which though they are not *truly* parts of the Body, yet for their usefulness ought not to be omitted.

They are of an horny transparent substance, coming nearest to that of Bones, fasten'd upon the ends of the Fingers and Toes for their defence. They are endued with no sense, nor is that colour which they appear to be of upon the Fingers, owing to their proper substance, but to the colour of the parts that lie under them; whence they sometimes look ruddy, sometimes pale, blue or yellow, and thereby give some intimation of the state of the Body. They grow very firmly to the Flesh that lies under them; and to fasten them the better, they are tied about their root with a Ligament, and on their sides the Skin closes them in. The parts that lie under them are very sensible, for there are several twigs of Nerves and tendons of Muscles that run to the
very

very Fingers ends; so that upon handling any hard or rugged thing we should have been continually in pain, if these so sensible parts had not been thus defended by the Nails.

They may in some sense be reputed parts of the Body, so as that it would not be perfect and intire without them: but that is but an improper notion of a part. For if they were properly parts, they should live by the common life of the Body; but that they do not, seeing *they* as well as the *hair* continue to grow after a Man is dead: and their growth seems meerly to be by apposition of new particles to their roots, which drive on successively those before them; as we may see when there is a black or white speck on any of them, for it still goes forward together with the Nail, till it arrive at the Fingers end beyond the Flesh.



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